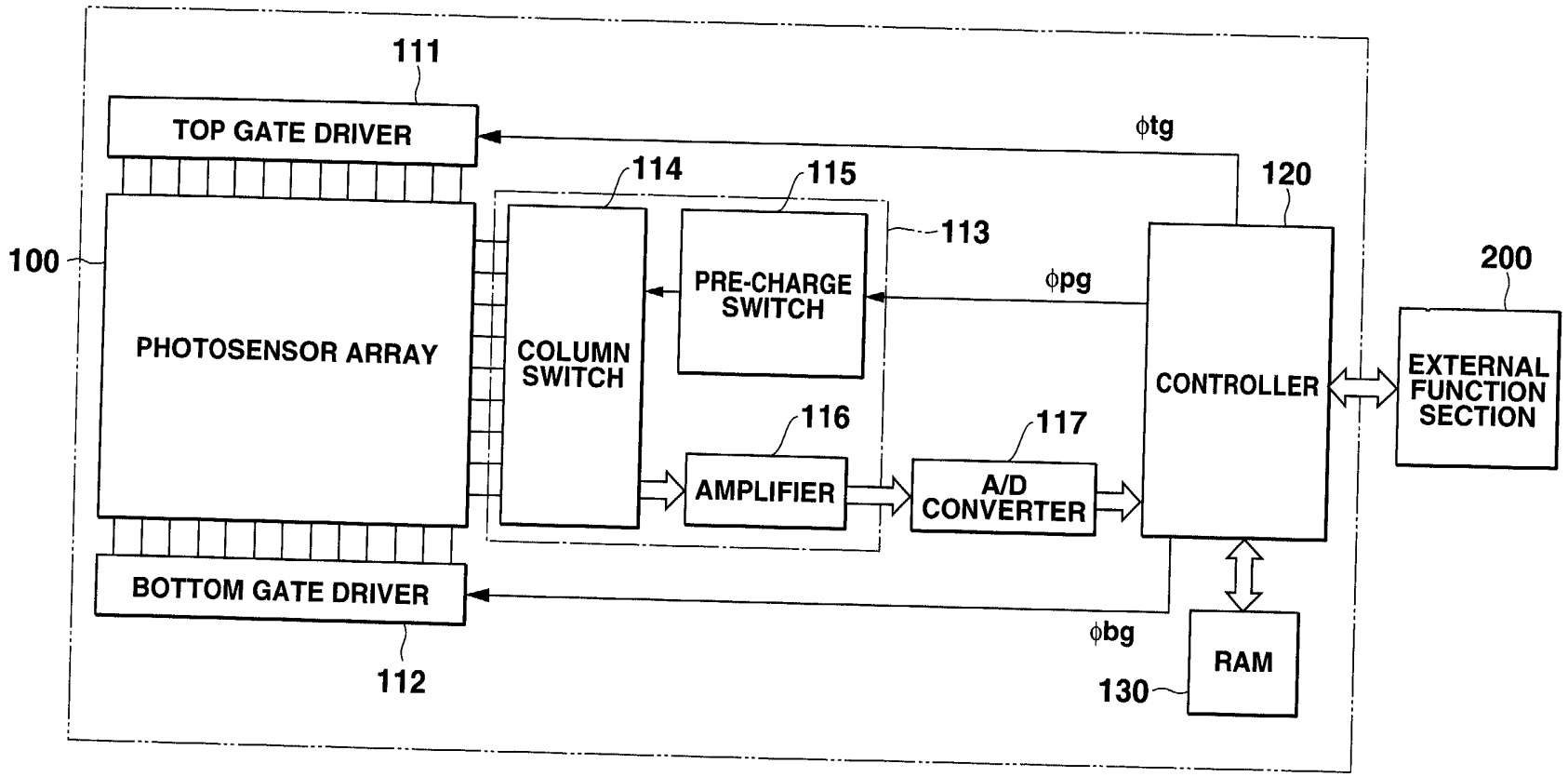

111
TOP GATE DRIVER
φtg
114
115
120
100
PHOTOSENSOR ARRAY
COLUMN SWITCH
PRE-CHARGE SWITCH
113
φpg
200
CONTROLLER
EXTERNAL FUNCTION SECTION
116
117
AMPLIFIER
A/D CONVERTER
BOTTOM GATE DRIVER
φbg
RAM
130
112

FIG.1

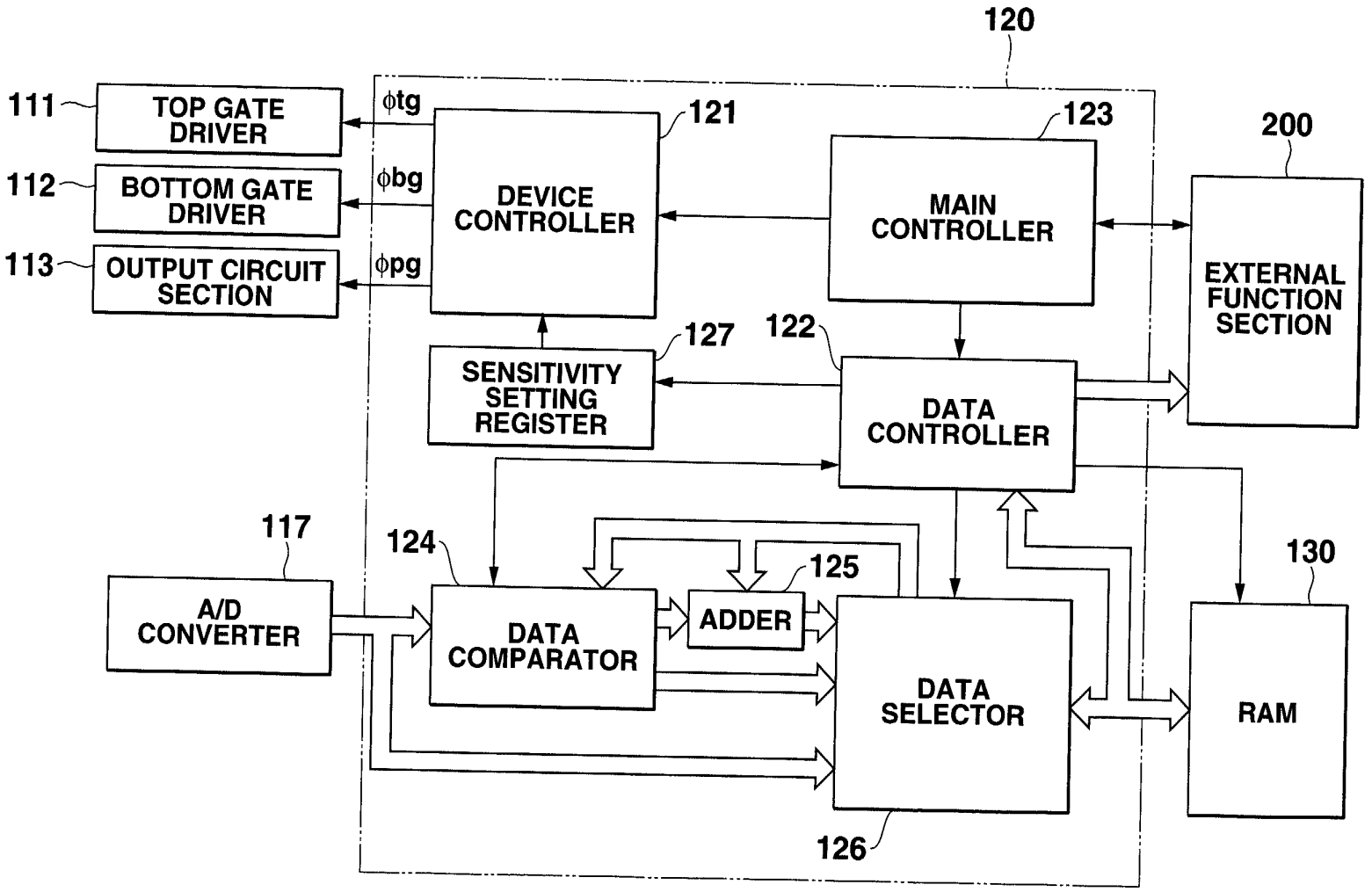

120
111
TOP GATE DRIVER
112
BOTTOM GATE DRIVER
113
OUTPUT CIRCUIT SECTION
φtg
φbg
φpg
DEVICE CONTROLLER
121
123
MAIN CONTROLLER
200
EXTERNAL FUNCTION SECTION
127
SENSITIVITY SETTING REGISTER
122
DATA CONTROLLER
117
A/D CONVERTER
124
DATA COMPARATOR
125
ADDER
DATA SELECTOR
130
RAM
126

FIG.2

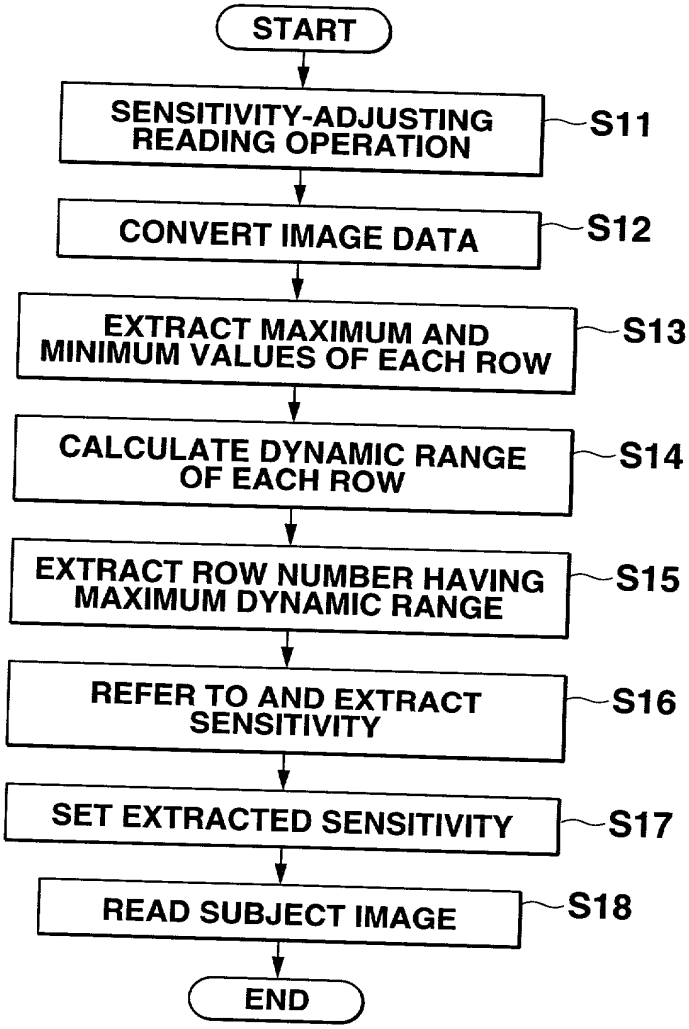

START
SENSITIVITY-ADJUSTING READING OPERATION
S11
CONVERT IMAGE DATA
S12
EXTRACT MAXIMUM AND MINIMUM VALUES OF EACH ROW
S13
CALCULATE DYNAMIC RANGE OF EACH ROW
S14
EXTRACT ROW NUMBER HAVING MAXIMUM DYNAMIC RANGE
S15
REFER TO AND EXTRACT SENSITIVITY
S16
SET EXTRACTED SENSITIVITY
S17
READ SUBJECT IMAGE
S18
END

FIG.3

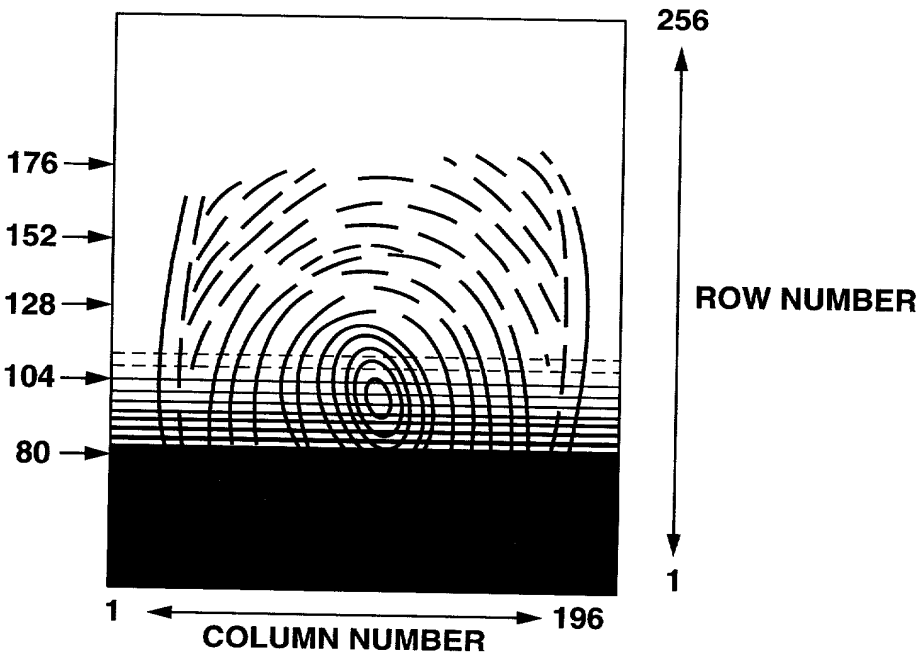


FIG.4

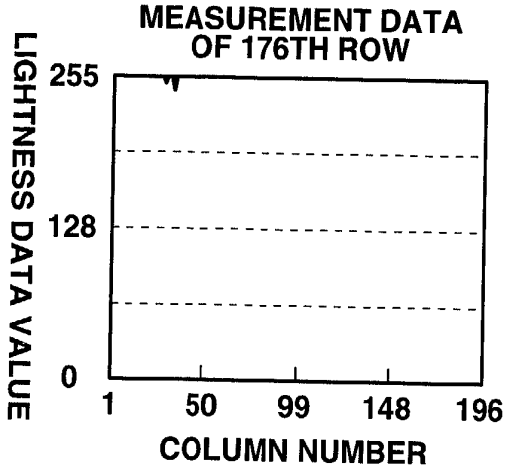


FIG.5A

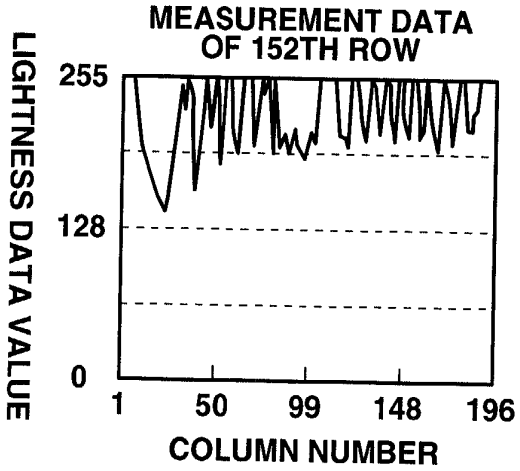


FIG.5B

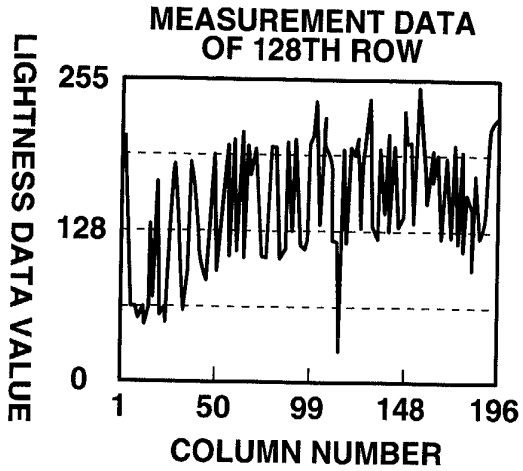


FIG.5C

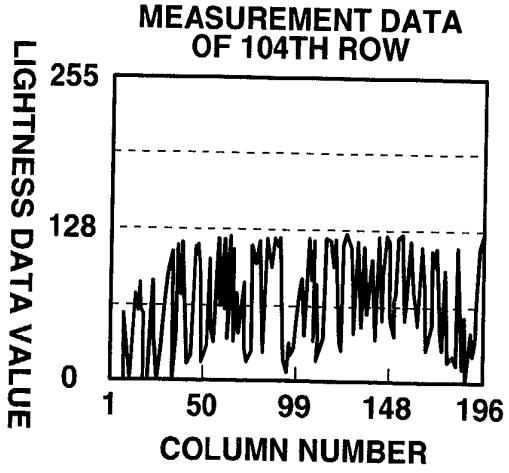


FIG.5D

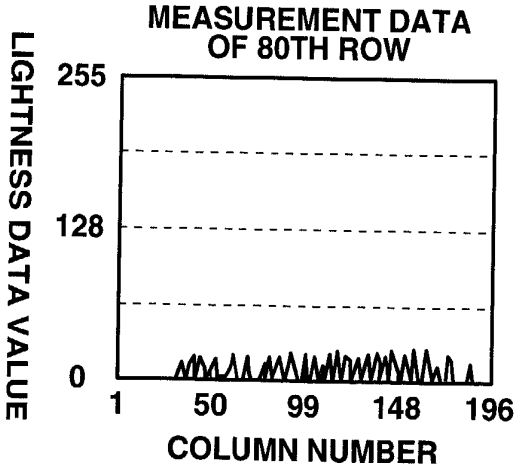


FIG.5E

FIG.6A

ROW NUMBER	80TH ROW	104TH ROW	128TH ROW	152ND ROW	176TH ROW
MAXIMUM VALUE	25	127	251	255	255
MINIMUM VALUE	0	0	27	153	249
DYNAMIC RANGE	25	127	224	102	6

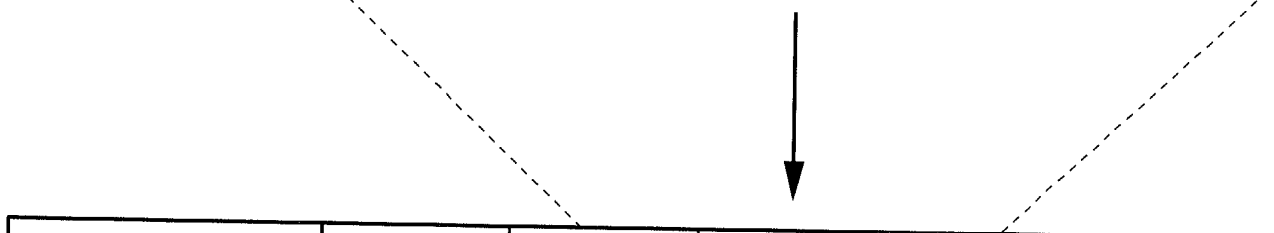


FIG.6B

ROW NUMBER	1ST ROW	. . .	128TH ROW	. . .	256TH ROW
CHARGE ACCUMLATING PERIOD	T_1	. . .	T_{128}	. . .	T_{256}

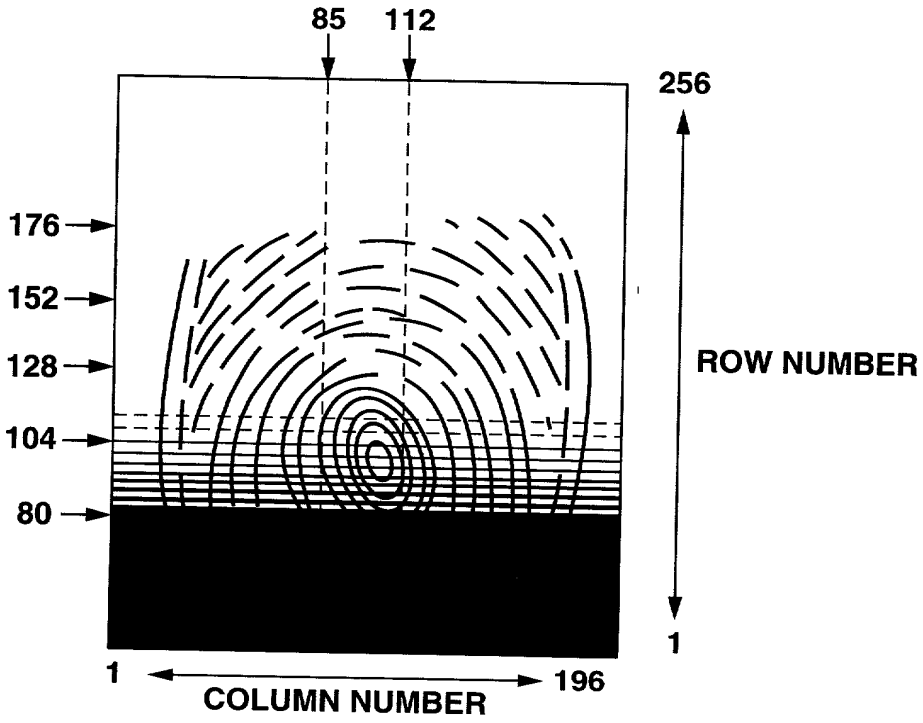


FIG.7

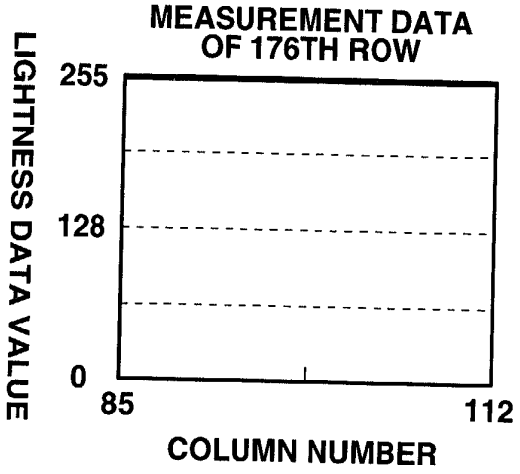


FIG.8A

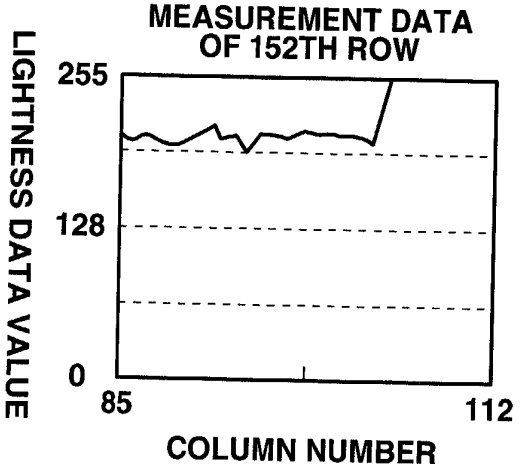


FIG.8B

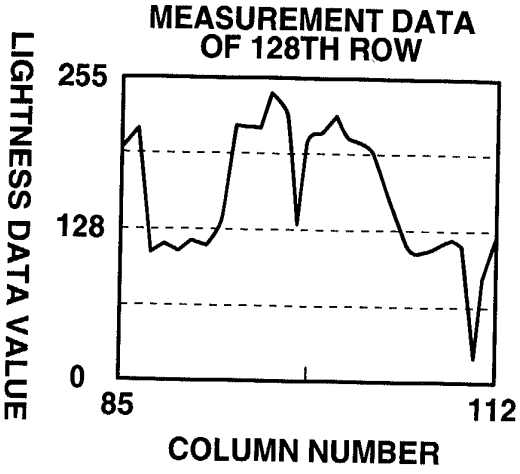


FIG.8C

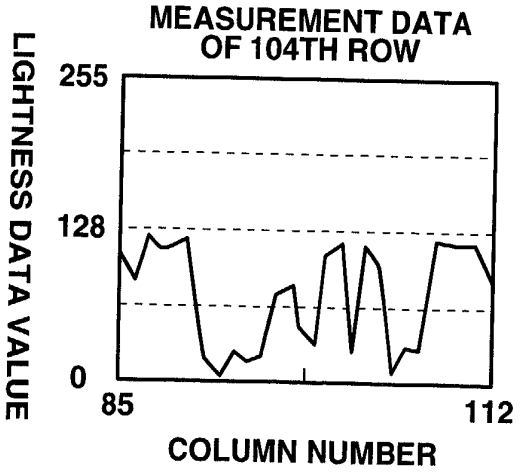


FIG.8D

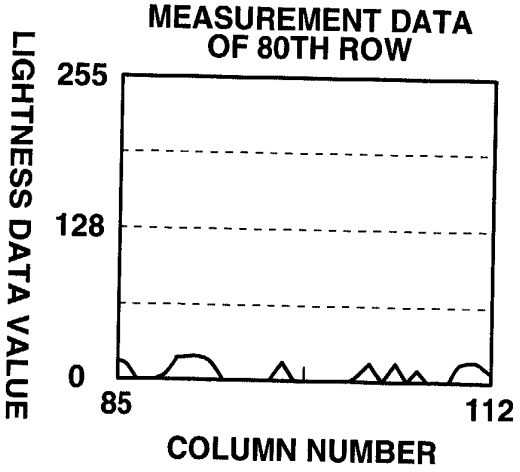


FIG.8E

FIG.9A

ROW NUMBER	80TH ROW	104TH ROW	128TH ROW	152ND ROW	176TH ROW
MAXIMUM VALUE	23	117	243	255	255
MINIMUM VALUE	0	9	27	193	255
DYNAMIC RANGE	23	108	216	62	0

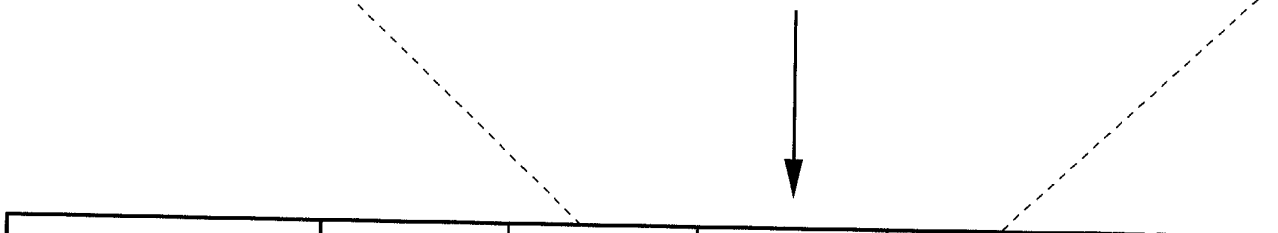


FIG.9B

ROW NUMBER	1ST ROW	. . .	128TH ROW	. . .	256TH ROW
CHARGE ACCUMLATING PERIOD	T_1	. . .	T_{128}	. . .	T_{256}

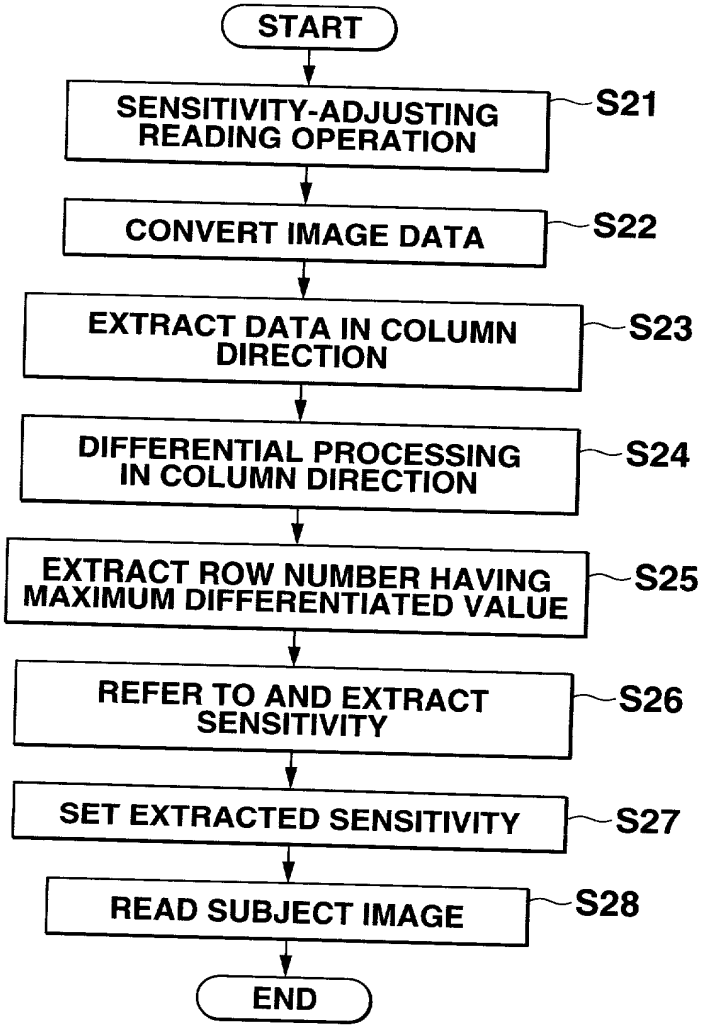

START
SENSITIVITY-ADJUSTING READING OPERATION
S21
CONVERT IMAGE DATA
S22
EXTRACT DATA IN COLUMN DIRECTION
S23
DIFFERENTIAL PROCESSING IN COLUMN DIRECTION
S24
EXTRACT ROW NUMBER HAVING MAXIMUM DIFFERENTIATED VALUE
S25
REFER TO AND EXTRACT SENSITIVITY
S26
SET EXTRACTED SENSITIVITY
S27
READ SUBJECT IMAGE
S28
END

FIG.10

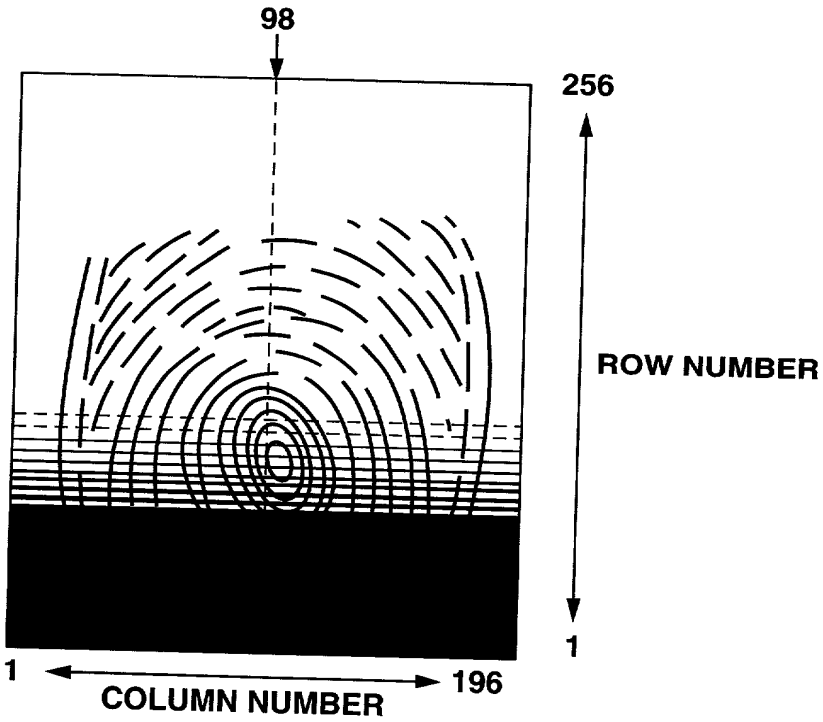


FIG.11

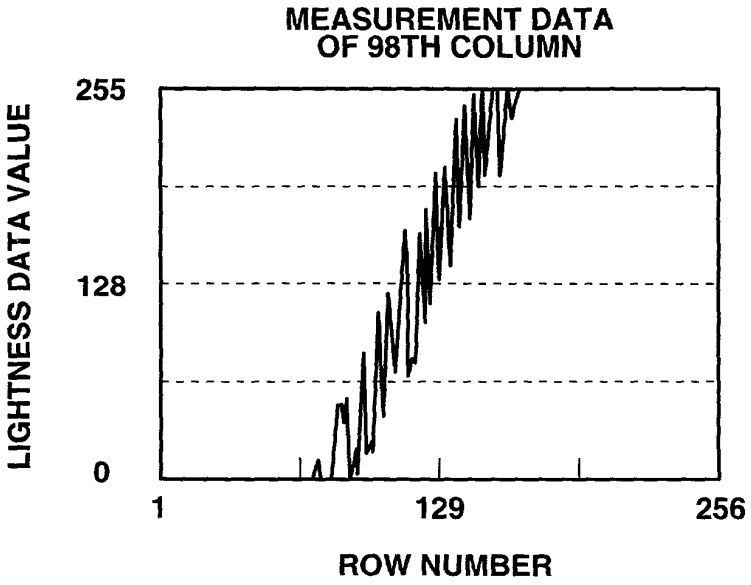


FIG.12A

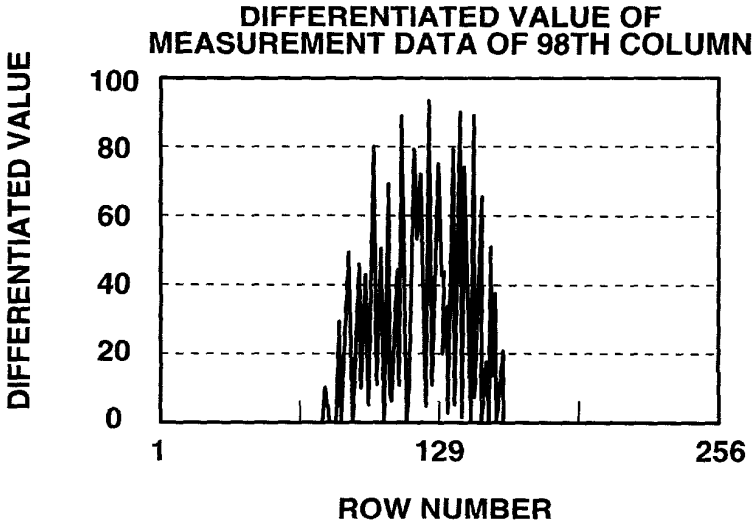


FIG.12B

FIG.13A

ROW NUMBER	. . .	121ST ROW	122ND ROW	123RD ROW	124TH ROW	125TH ROW	126TH ROW	127TH ROW	128TH ROW	129TH ROW	. . .
DIFFERENTIATED VALUE	. . .	80	53	72	5	95	11	76	20	. . .	

FIG.13B

ROW NUMBER	. . .	121ST ROW	122ND ROW	123RD ROW	124TH ROW	125TH ROW	126TH ROW	127TH ROW	128TH ROW	129TH ROW	. . .
CHARGE ACCUMLATING PERIOD	. . .	T_{121}	T_{122}	T_{123}	T_{124}	T_{125}	T_{126}	T_{127}	T_{128}	T_{129}	. . .

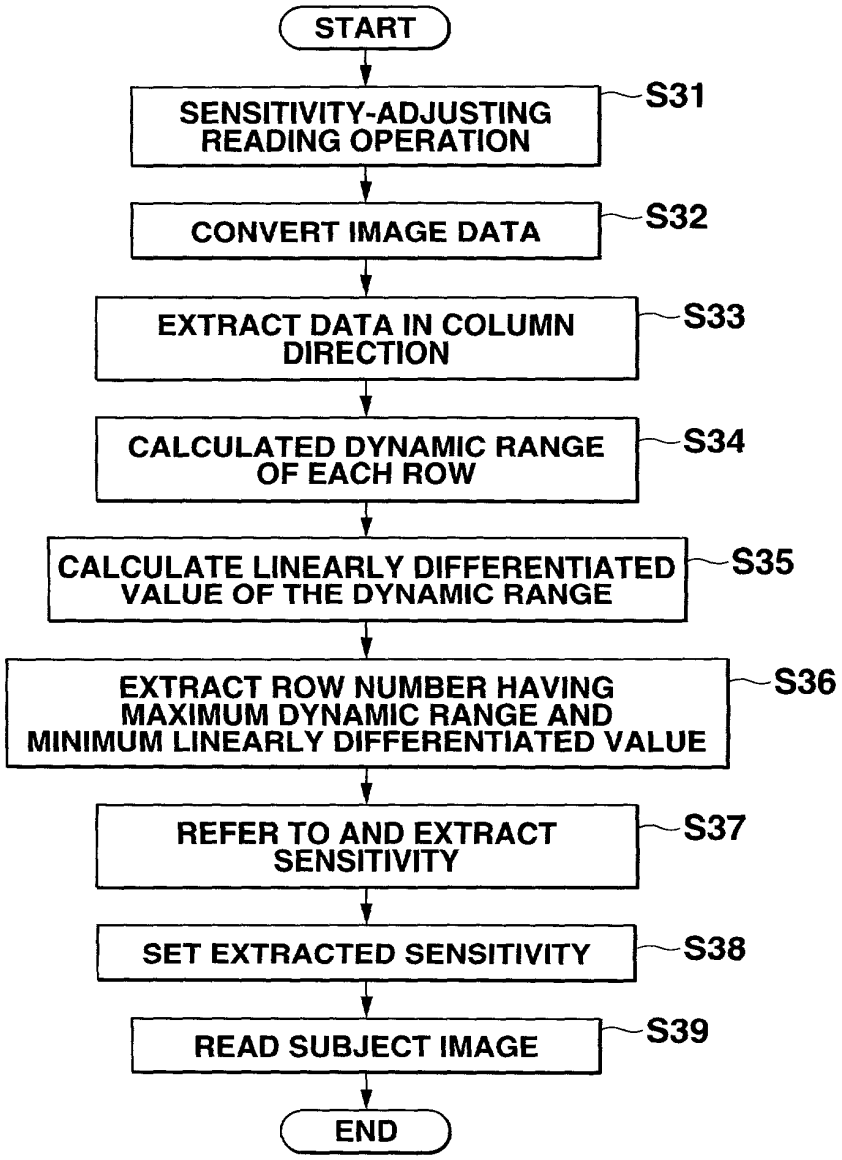

START
SENSITIVITY-ADJUSTING READING OPERATION
S31
CONVERT IMAGE DATA
S32
EXTRACT DATA IN COLUMN DIRECTION
S33
CALCULATED DYNAMIC RANGE OF EACH ROW
S34
CALCULATE LINEARLY DIFFERENTIATED VALUE OF THE DYNAMIC RANGE
S35
EXTRACT ROW NUMBER HAVING MAXIMUM DYNAMIC RANGE AND MINIMUM LINEARLY DIFFERENTIATED VALUE
S36
REFER TO AND EXTRACT SENSITIVITY
S37
SET EXTRACTED SENSITIVITY
S38
READ SUBJECT IMAGE
S39
END

FIG.14

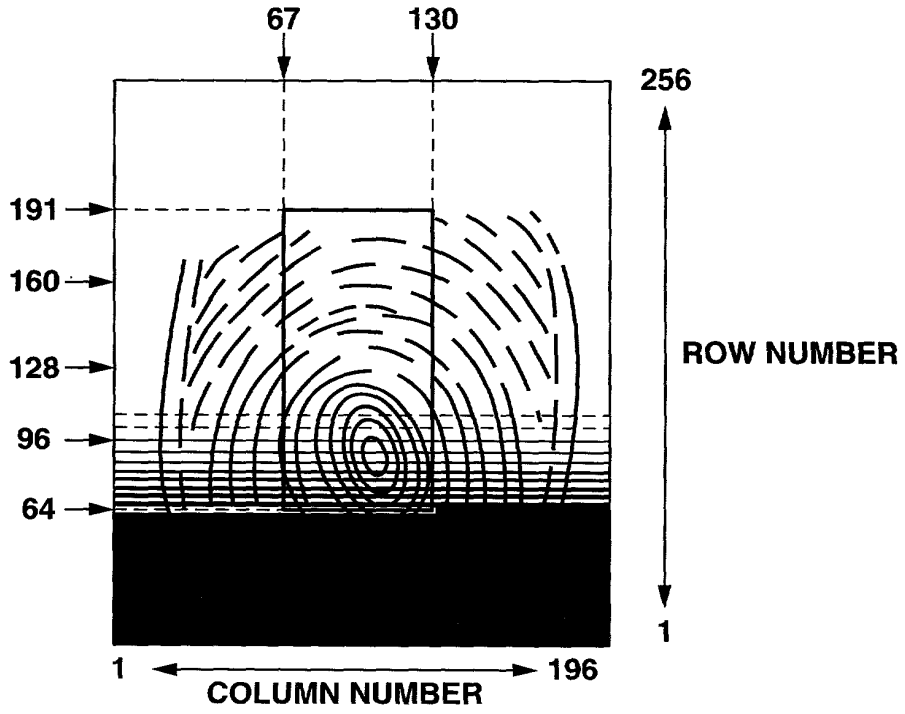


FIG.15

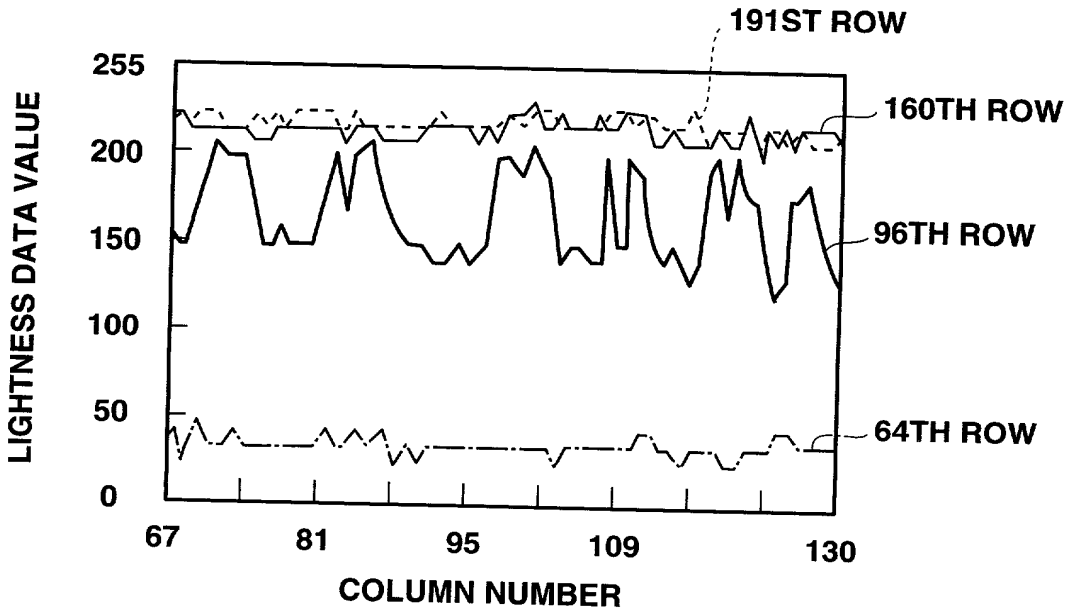

191ST ROW
160TH ROW
96TH ROW
64TH ROW
255
200
150
100
50
0
LIGHTNESS DATA VALUE
67
81
95
109
130
COLUMN NUMBER

FIG.16

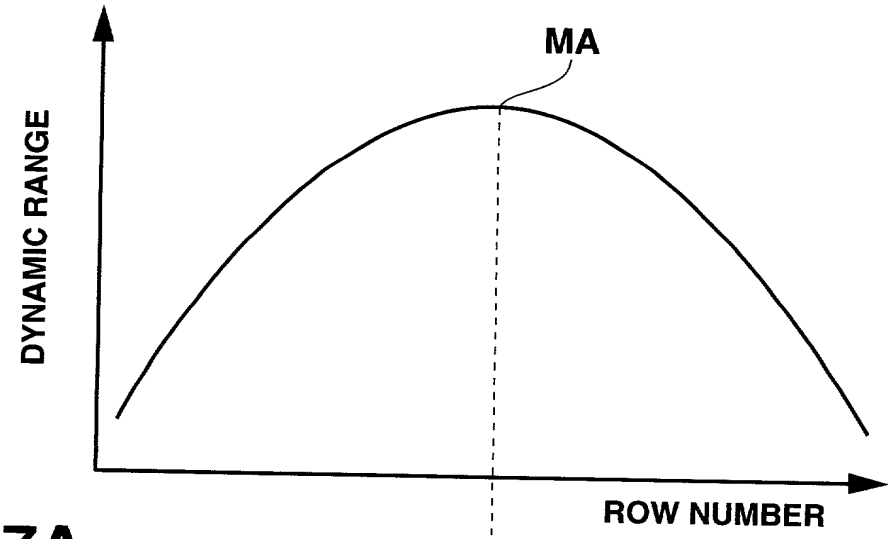


FIG.17A

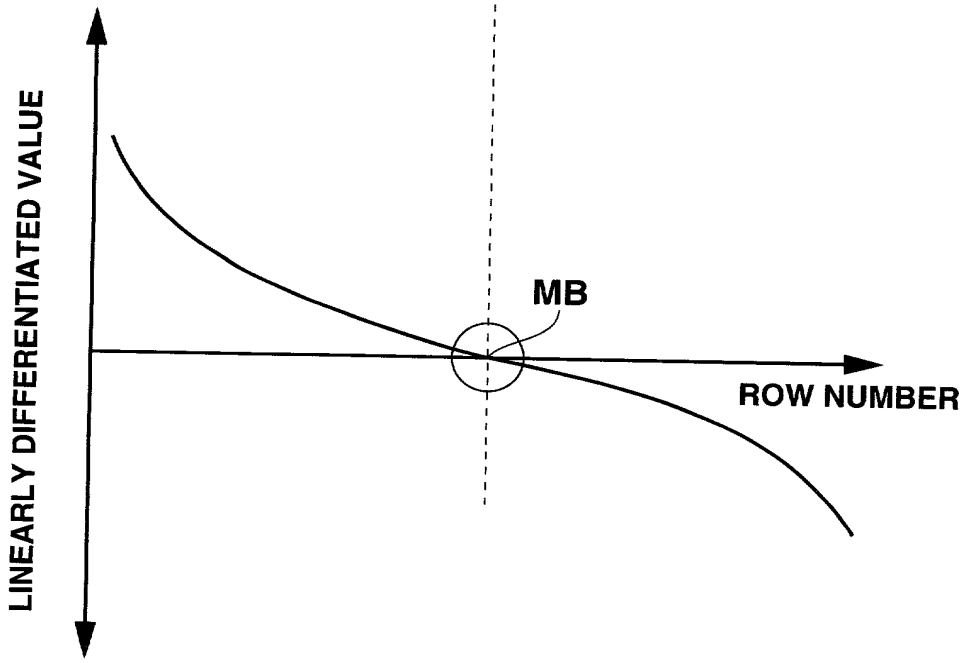


FIG.17B

FIG.18A

ROW NUMBER	64TH ROW	. . .	Lk-1 ROW	Lk ROW	Lk+1 ROW	. . .	191ST ROW
MAXIMUM VALUE	X_{64}	. . .	X_{K-1}	X_K	X_{K+1}	. . .	X_{191}
MINIMUM VALUE	Y_{64}	. . .	Y_{K-1}	Y_K	Y_{K+1}	. . .	Y_{191}
DYNAMIC RANGE	R_{64}	. . .	R_{K-1}	$R_{K(MAX)}$	R_{K+1}	. . .	R_{191}
LINEARLY DIFFERENTIATED VALUE	. . .	D_{k-2}	$D_{k-1(MIN)}$	D_k	D_{k+1}	. . .	

FIG.18B

ROW NUMBER	64TH ROW	. . .	Lk-1 ROW	Lk ROW	Lk+1 ROW	. . .	191ST ROW
CHARGE ACCUMLATING PERIOD	T_{64}	. . .	T_{k-1}	T_k	T_{k+1}	. . .	T_{191}

FIG.19A

ROW NUMBER	64TH ROW	. . .	Lk-1 ROW	Lk ROW	Lk+1 ROW	. . .	191ST ROW
MAXIMUM VALUE	X_{64}	. . .	X_{K-1}	X_K	X_{K+1}	. . .	X_{191}
MINIMUM VALUE	Y_{64}	. . .	Y_{K-1}	Y_K	Y_{K+1}	. . .	Y_{191}
DYNAMIC RANGE	R_{64}	. . .	R_{K-1}	$R_{K(MAX)}$	R_{K+1}	. . .	R_{191}

FIG.19B

ROW NUMBER	64TH ROW	. . .	Lk-1 ROW	Lk ROW	Lk+1 ROW	. . .	191ST ROW
CHARGE ACCUMLATING PERIOD	T_{64}	. . .	T_{k-1}	T_k	T_{k+1}	. . .	T_{191}

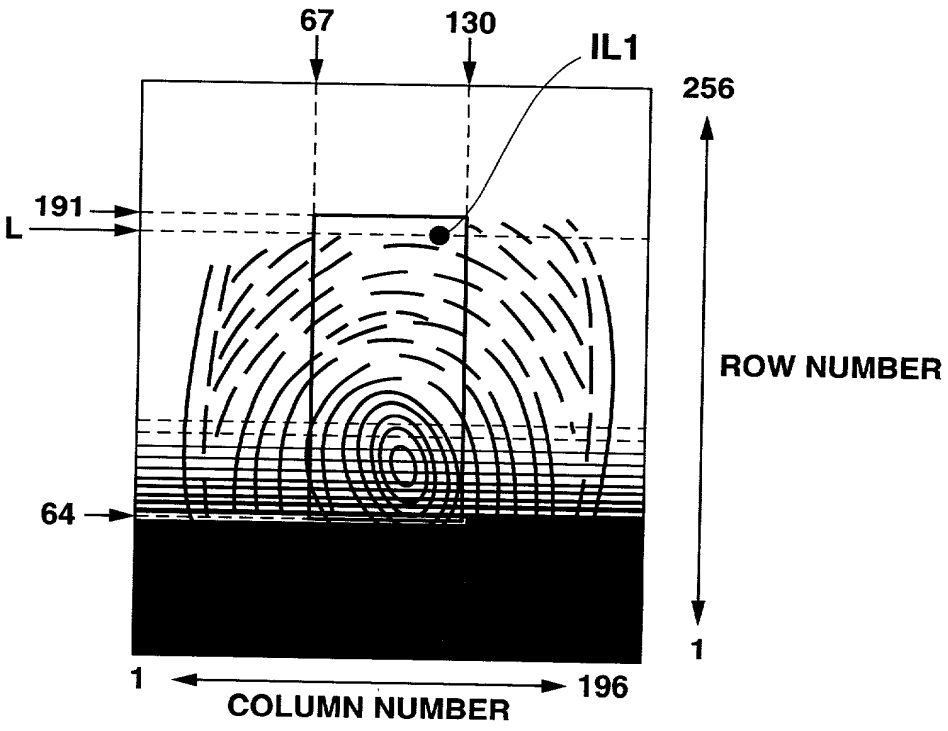


FIG.20

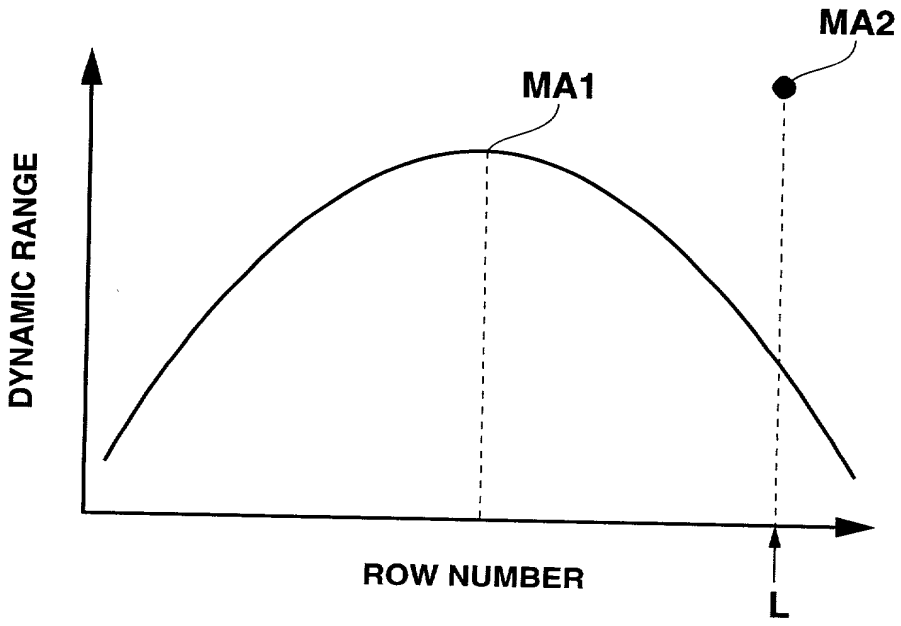


FIG.21

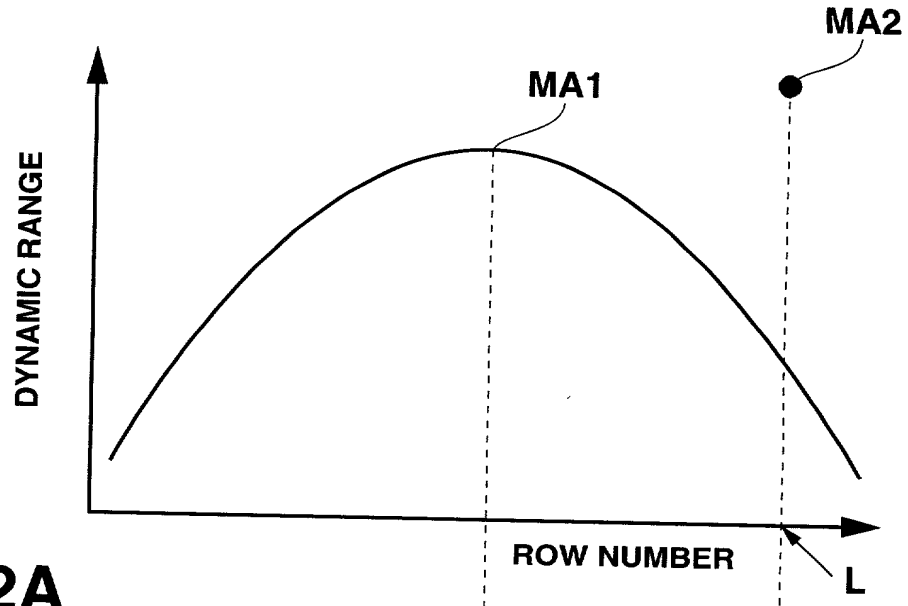


FIG.22A

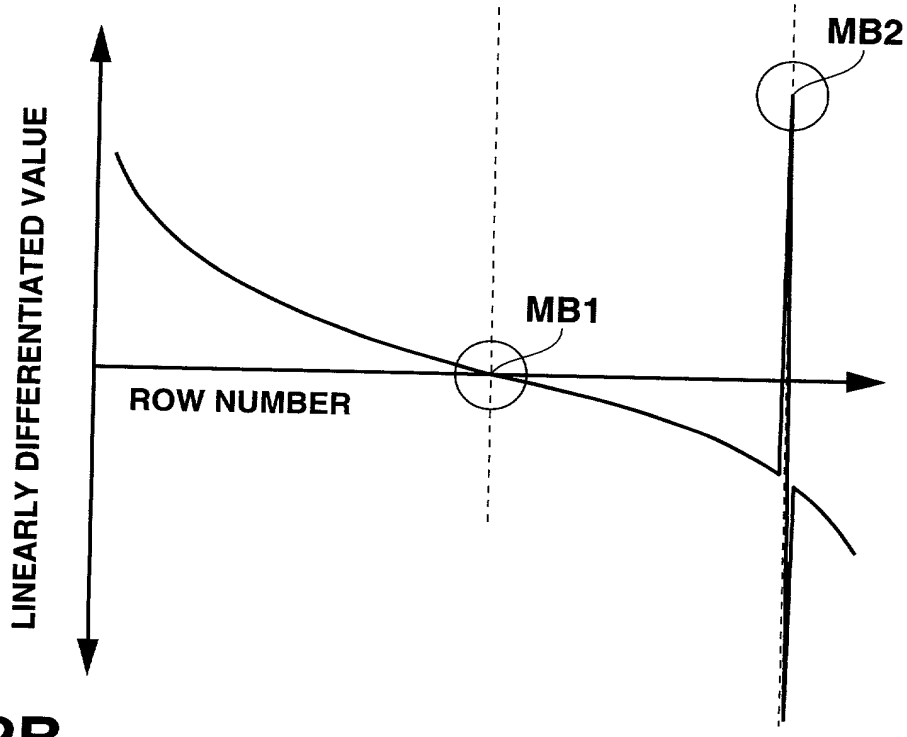


FIG.22B

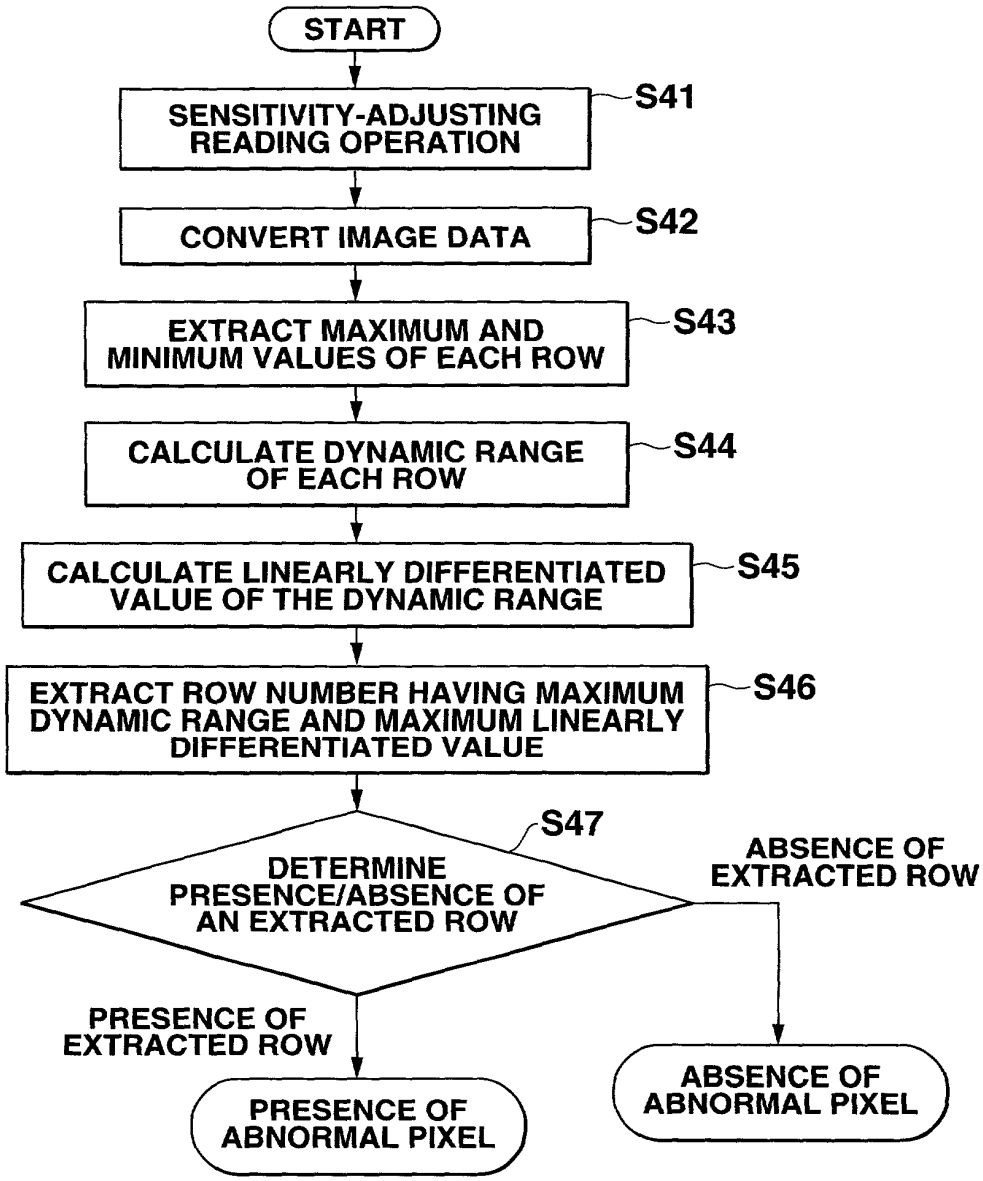

START
SENSITIVITY-ADJUSTING READING OPERATION
S41
CONVERT IMAGE DATA
S42
EXTRACT MAXIMUM AND MINIMUM VALUES OF EACH ROW
S43
CALCULATE DYNAMIC RANGE OF EACH ROW
S44
CALCULATE LINEARLY DIFFERENTIATED VALUE OF THE DYNAMIC RANGE
S45
EXTRACT ROW NUMBER HAVING MAXIMUM DYNAMIC RANGE AND MAXIMUM LINEARLY DIFFERENTIATED VALUE
S46
S47
DETERMINE PRESENCE/ABSENCE OF AN EXTRACTED ROW
ABSENCE OF EXTRACTED ROW
PRESENCE OF EXTRACTED ROW
PRESENCE OF ABNORMAL PIXEL
ABSENCE OF ABNORMAL PIXEL

FIG.23

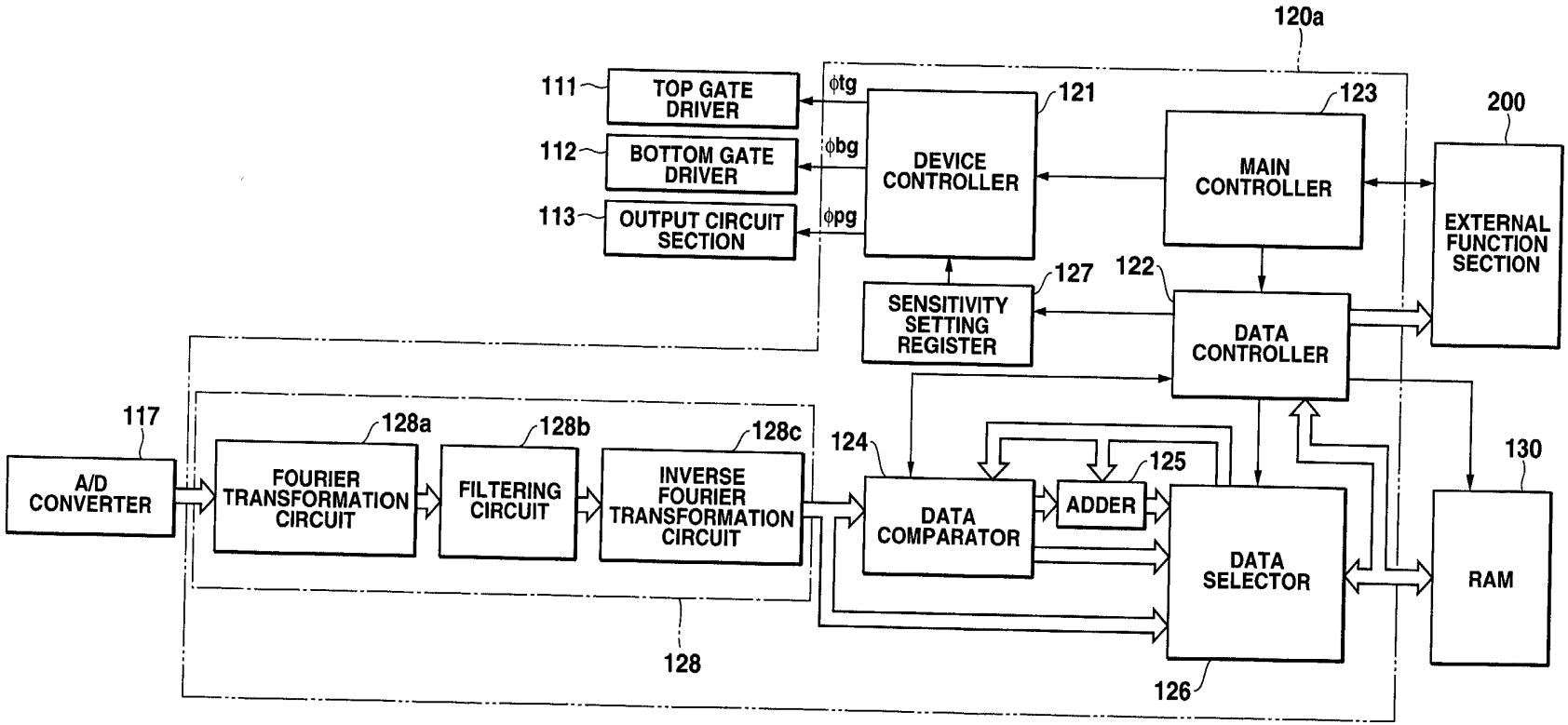

120a
111
TOP GATE DRIVER
112
BOTTOM GATE DRIVER
113
OUTPUT CIRCUIT SECTION
φtg
φbg
φpg
DEVICE CONTROLLER
121
123
MAIN CONTROLLER
200
EXTERNAL FUNCTION SECTION
127
SENSITIVITY SETTING REGISTER
122
DATA CONTROLLER
117
A/D CONVERTER
128a
FOURIER TRANSFORMATION CIRCUIT
128b
FILTERING CIRCUIT
128c
INVERSE FOURIER TRANSFORMATION CIRCUIT
128
124
DATA COMPARATOR
125
ADDER
DATA SELECTOR
126
130
RAM

FIG.24

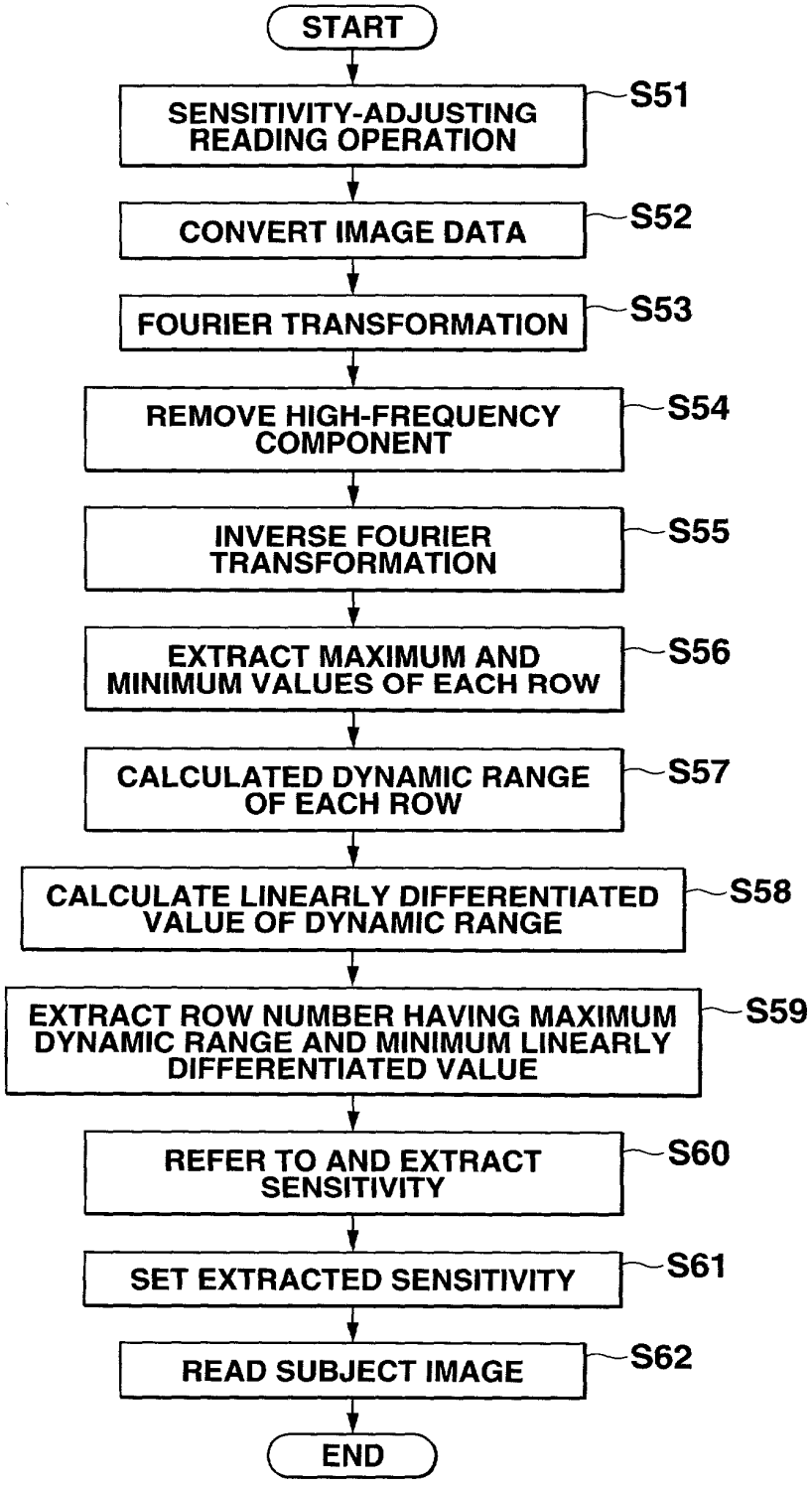

START
SENSITIVITY-ADJUSTING READING OPERATION
S51
CONVERT IMAGE DATA
S52
FOURIER TRANSFORMATION
S53
REMOVE HIGH-FREQUENCY COMPONENT
S54
INVERSE FOURIER TRANSFORMATION
S55
EXTRACT MAXIMUM AND MINIMUM VALUES OF EACH ROW
S56
CALCULATED DYNAMIC RANGE OF EACH ROW
S57
CALCULATE LINEARLY DIFFERENTIATED VALUE OF DYNAMIC RANGE
S58
EXTRACT ROW NUMBER HAVING MAXIMUM DYNAMIC RANGE AND MINIMUM LINEARLY DIFFERENTIATED VALUE
S59
REFER TO AND EXTRACT SENSITIVITY
S60
SET EXTRACTED SENSITIVITY
S61
READ SUBJECT IMAGE
S62
END

FIG.25

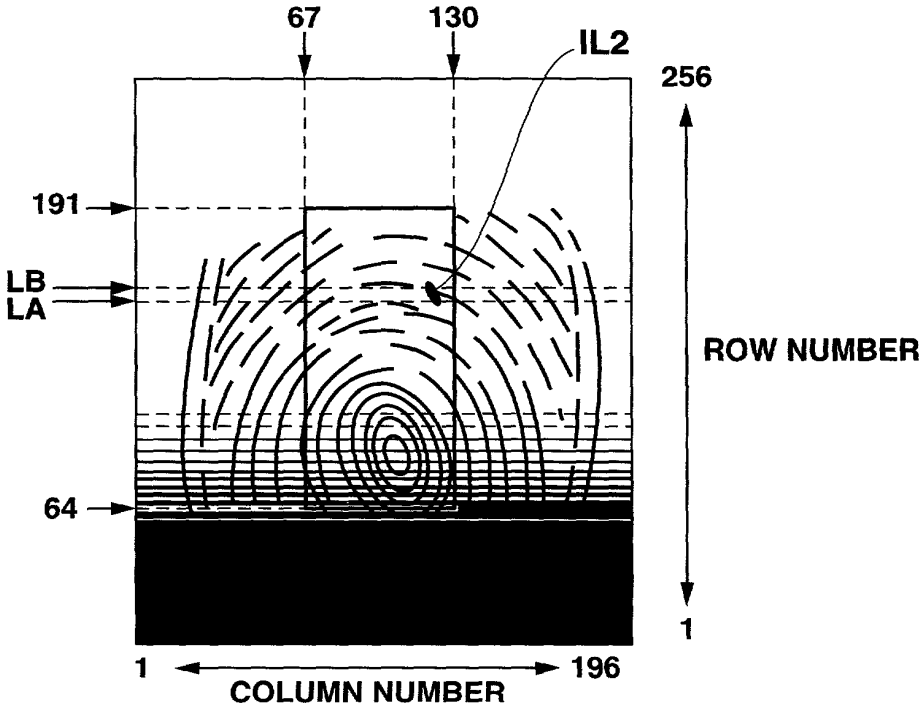


FIG.26

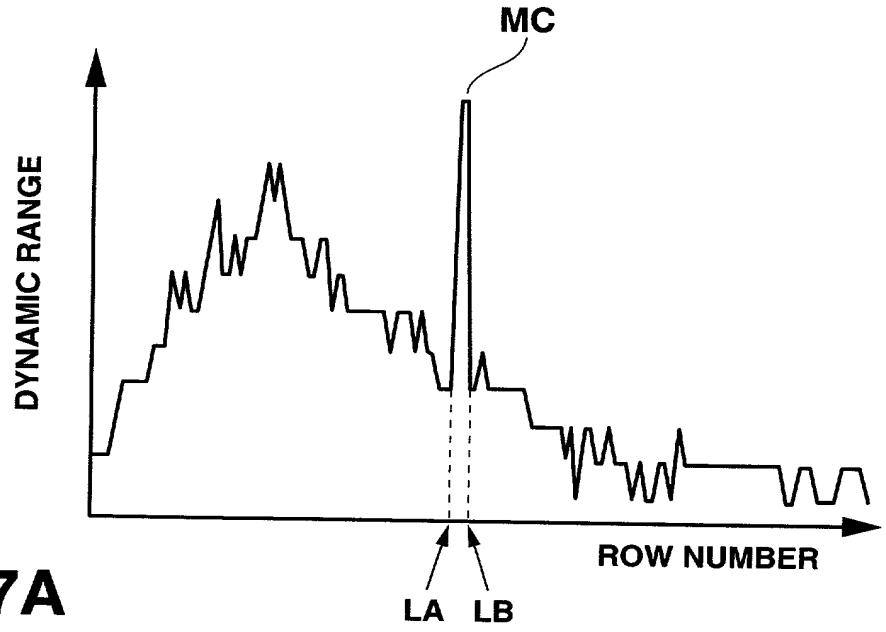


FIG.27A

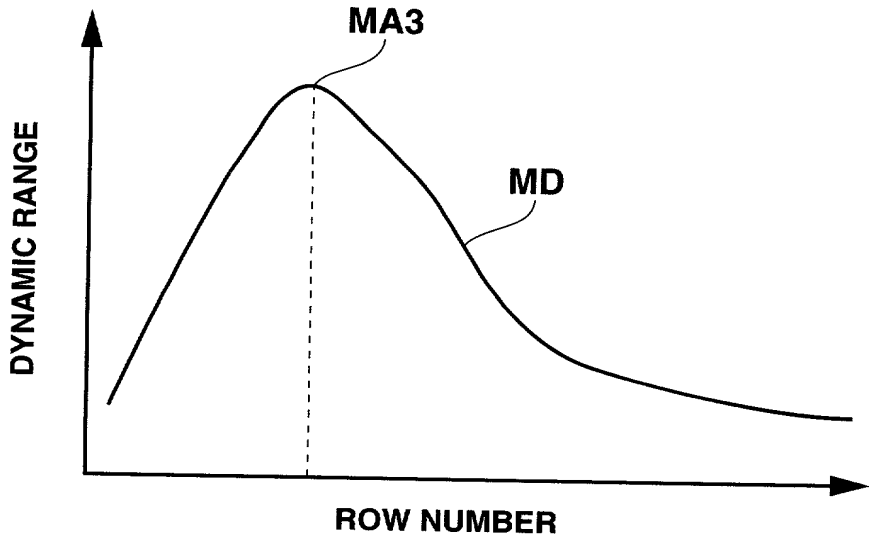


FIG.27B

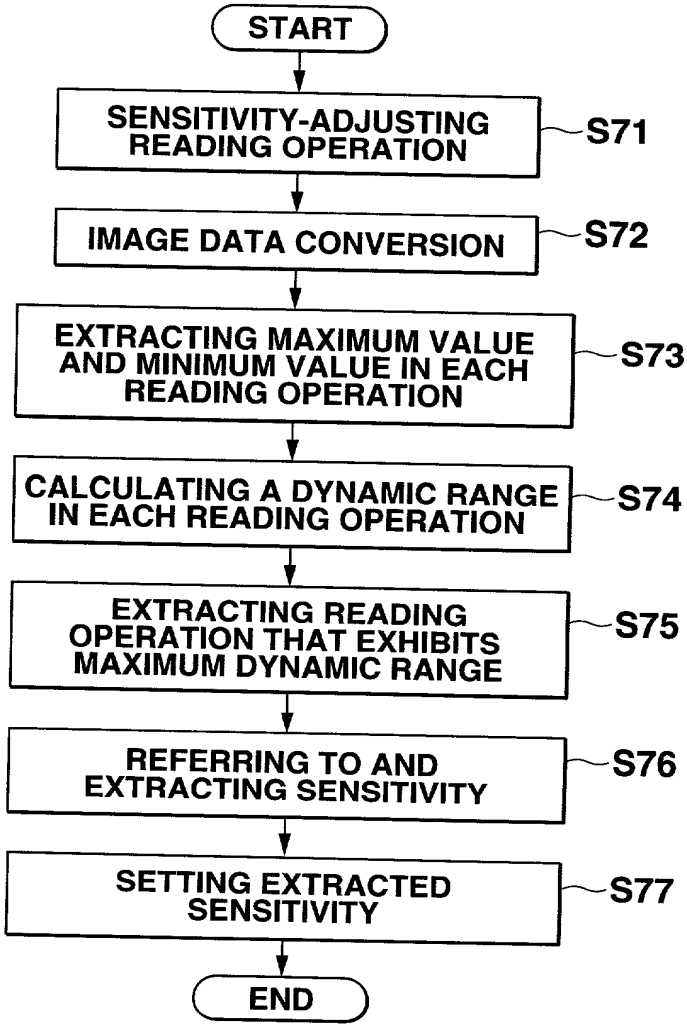

START
SENSITIVITY-ADJUSTING READING OPERATION
S71
IMAGE DATA CONVERSION
S72
EXTRACTING MAXIMUM VALUE AND MINIMUM VALUE IN EACH READING OPERATION
S73
CALCULATING A DYNAMIC RANGE IN EACH READING OPERATION
S74
EXTRACTING READING OPERATION THAT EXHIBITS MAXIMUM DYNAMIC RANGE
S75
REFERRING TO AND EXTRACTING SENSITIVITY
S76
SETTING EXTRACTED SENSITIVITY
S77
END

FIG.28

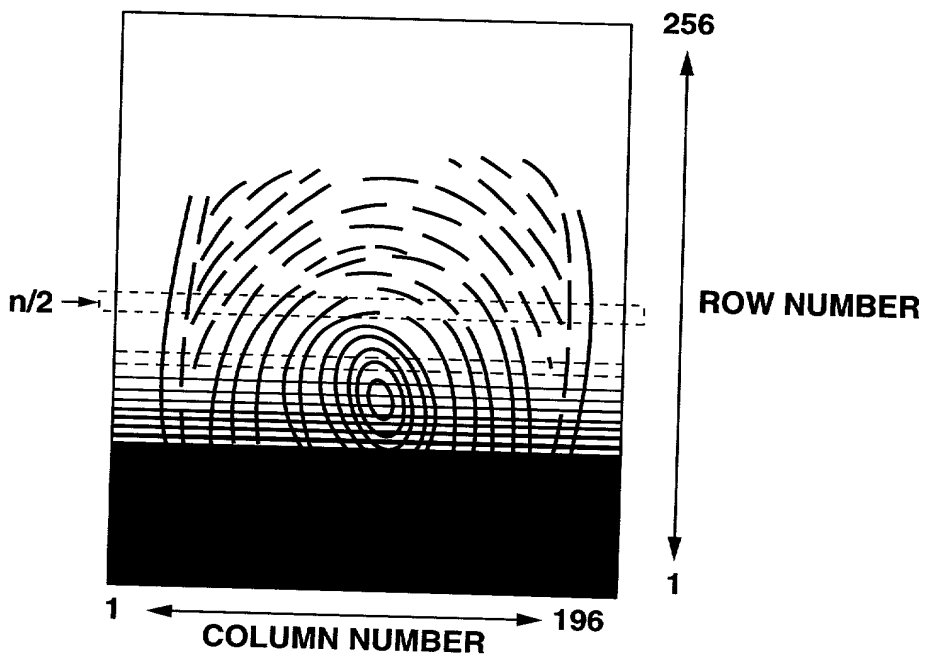


FIG.29

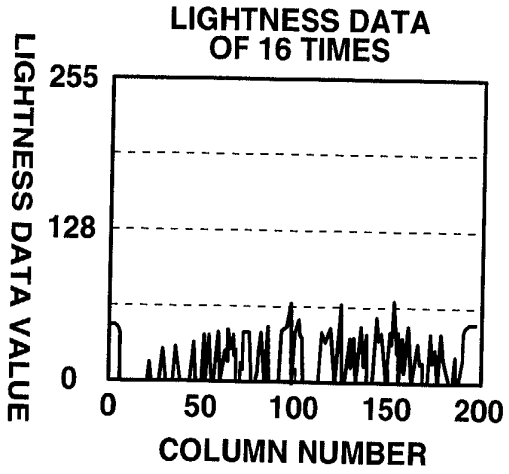


FIG.30A

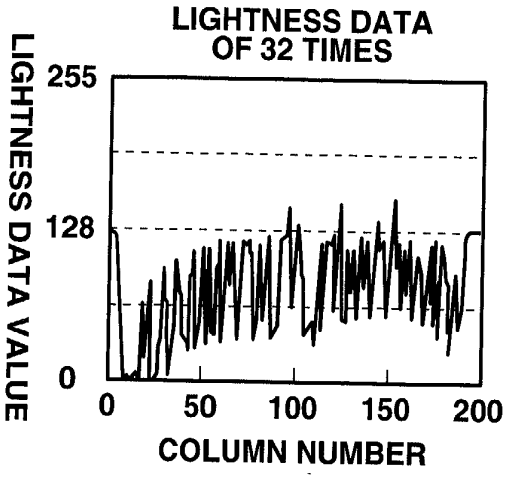


FIG.30B

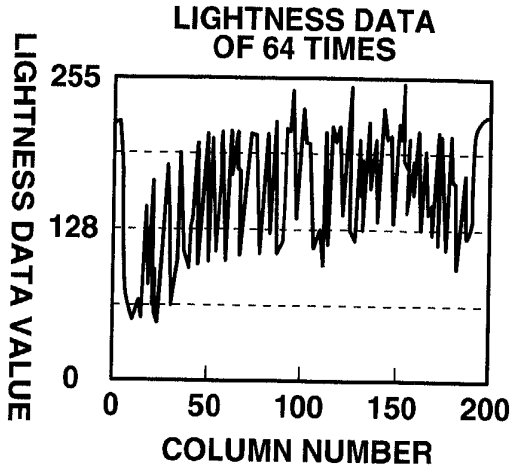


FIG.30C

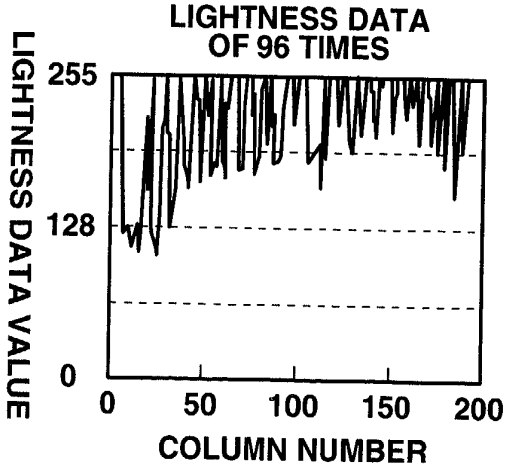


FIG.30D

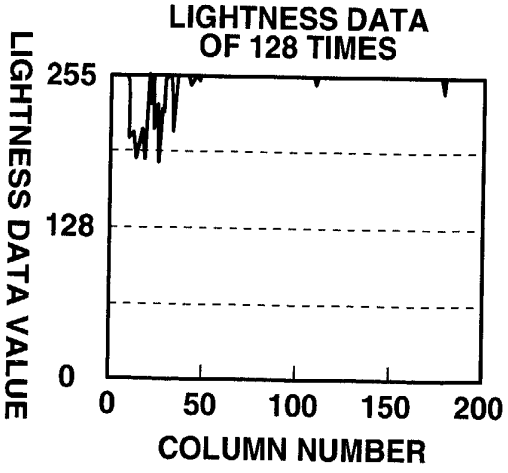


FIG.30E

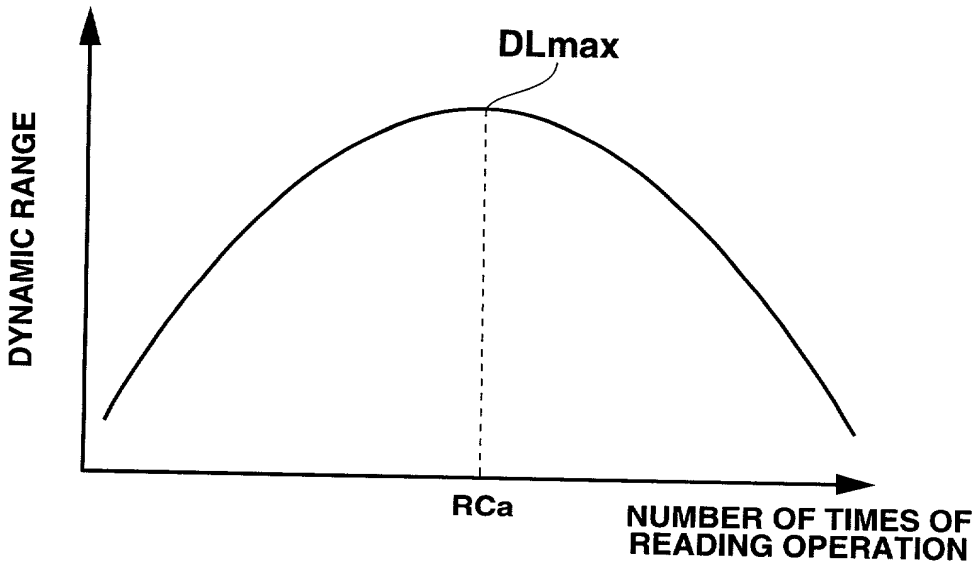

DLmax
DYNAMIC RANGE
RCa
NUMBER OF TIMES OF
READING OPERATION

FIG.31

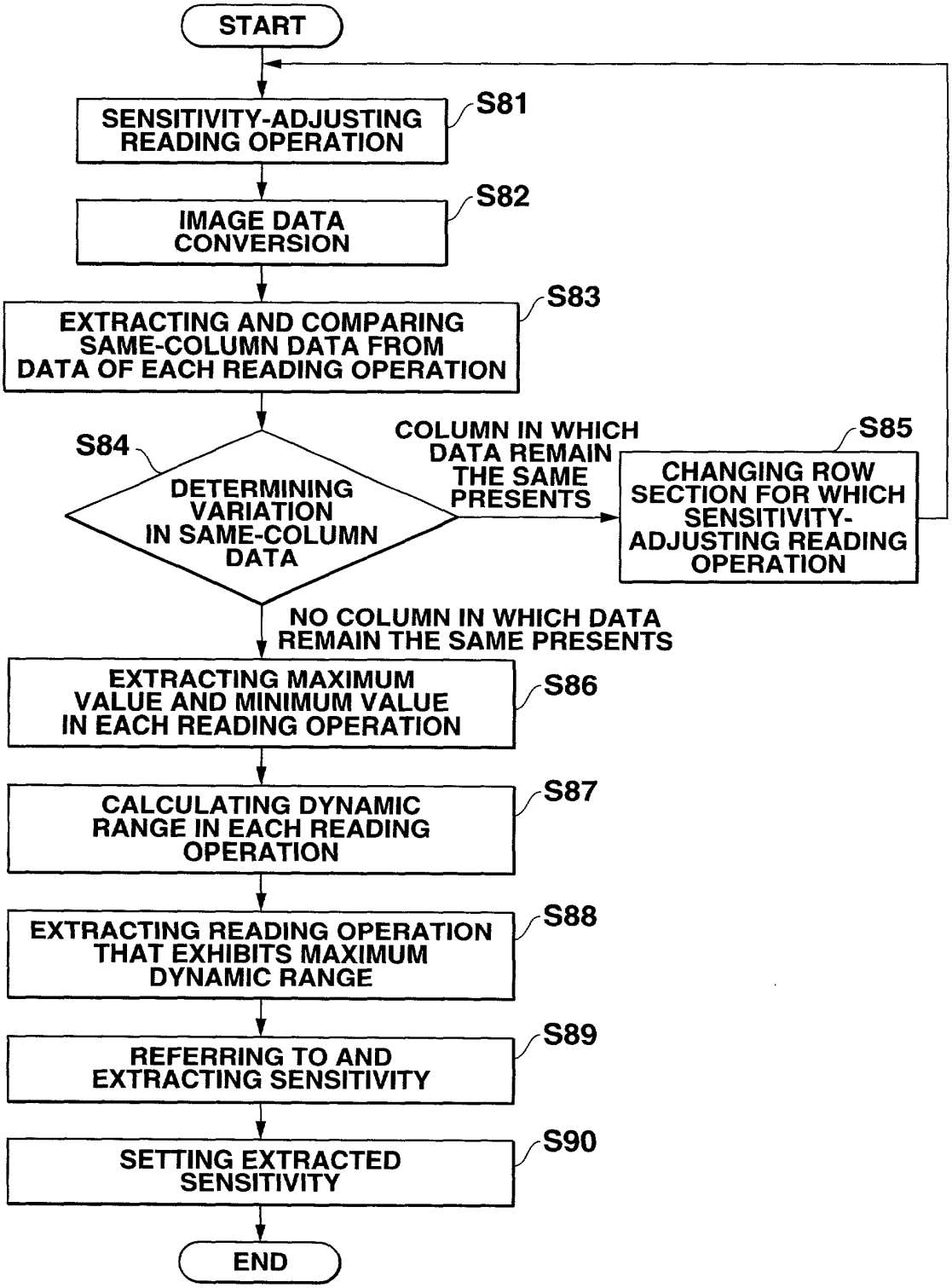

START
SENSITIVITY-ADJUSTING READING OPERATION
S81
IMAGE DATA CONVERSION
S82
EXTRACTING AND COMPARING SAME-COLUMN DATA FROM DATA OF EACH READING OPERATION
S83
S84
DETERMINING VARIATION IN SAME-COLUMN DATA
COLUMN IN WHICH DATA REMAIN THE SAME PRESENTS
S85
CHANGING ROW SECTION FOR WHICH SENSITIVITY-ADJUSTING READING OPERATION
NO COLUMN IN WHICH DATA REMAIN THE SAME PRESENTS
EXTRACTING MAXIMUM VALUE AND MINIMUM VALUE IN EACH READING OPERATION
S86
CALCULATING DYNAMIC RANGE IN EACH READING OPERATION
S87
EXTRACTING READING OPERATION THAT EXHIBITS MAXIMUM DYNAMIC RANGE
S88
REFERRING TO AND EXTRACTING SENSITIVITY
S89
SETTING EXTRACTED SENSITIVITY
S90
END

FIG.32

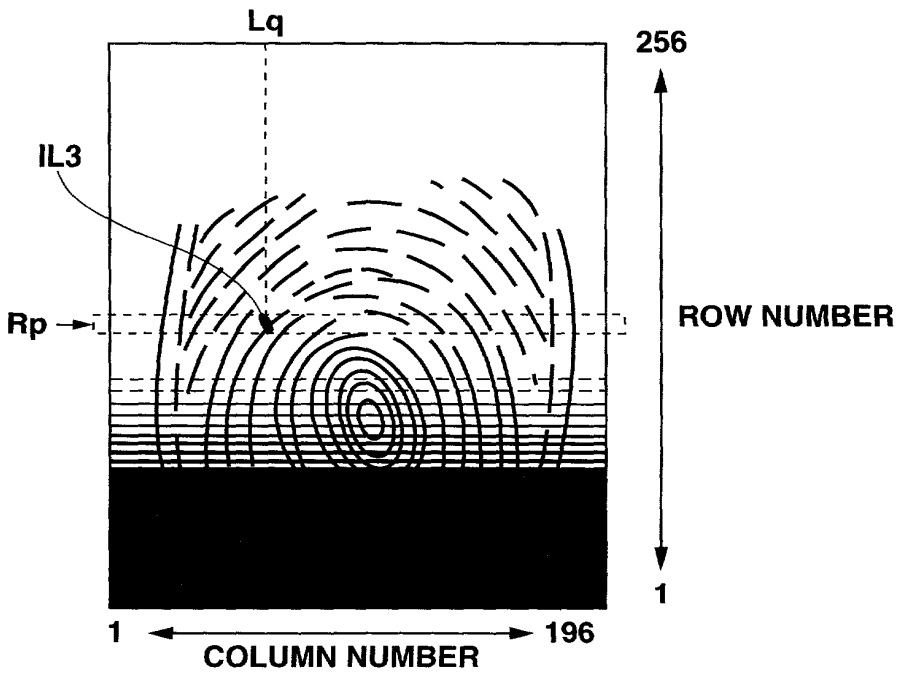


FIG.33

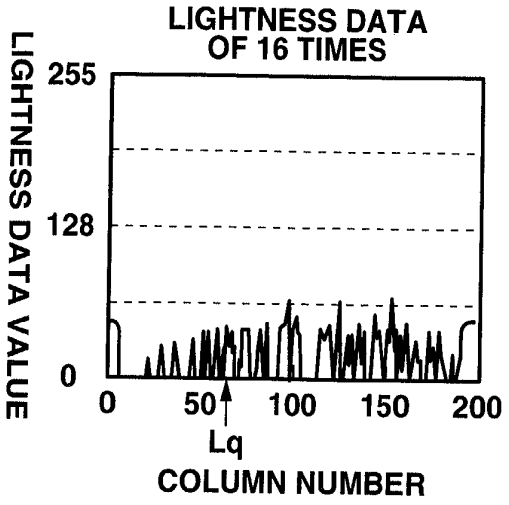


FIG.34A

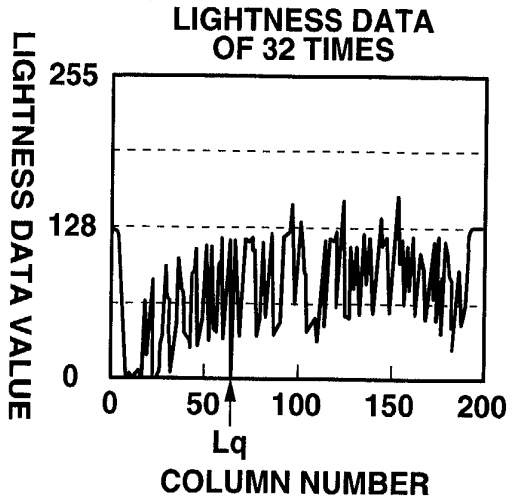


FIG.34B

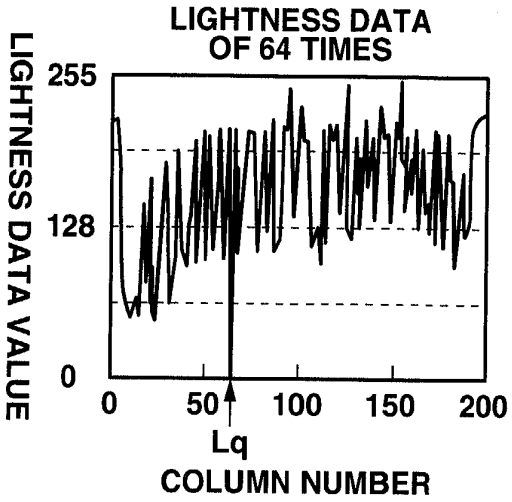


FIG.34C

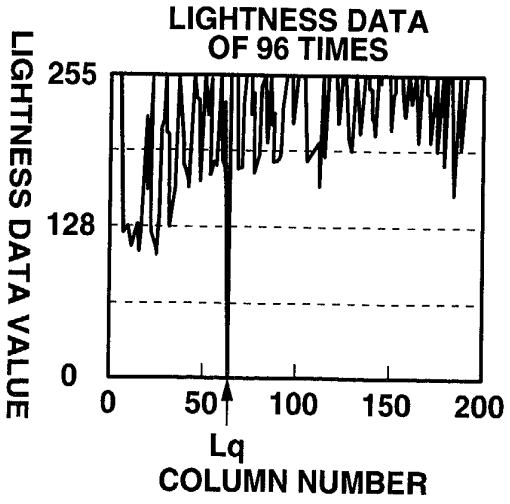


FIG.34D

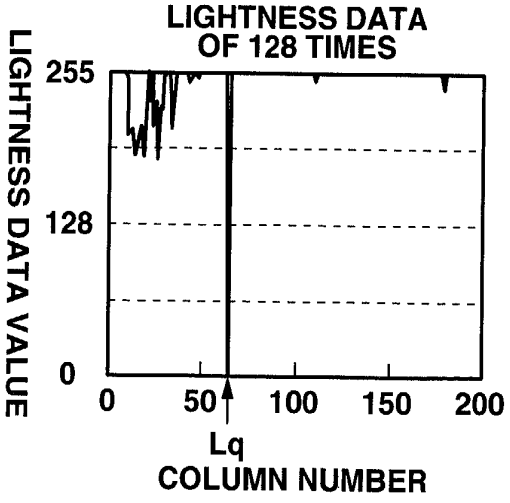
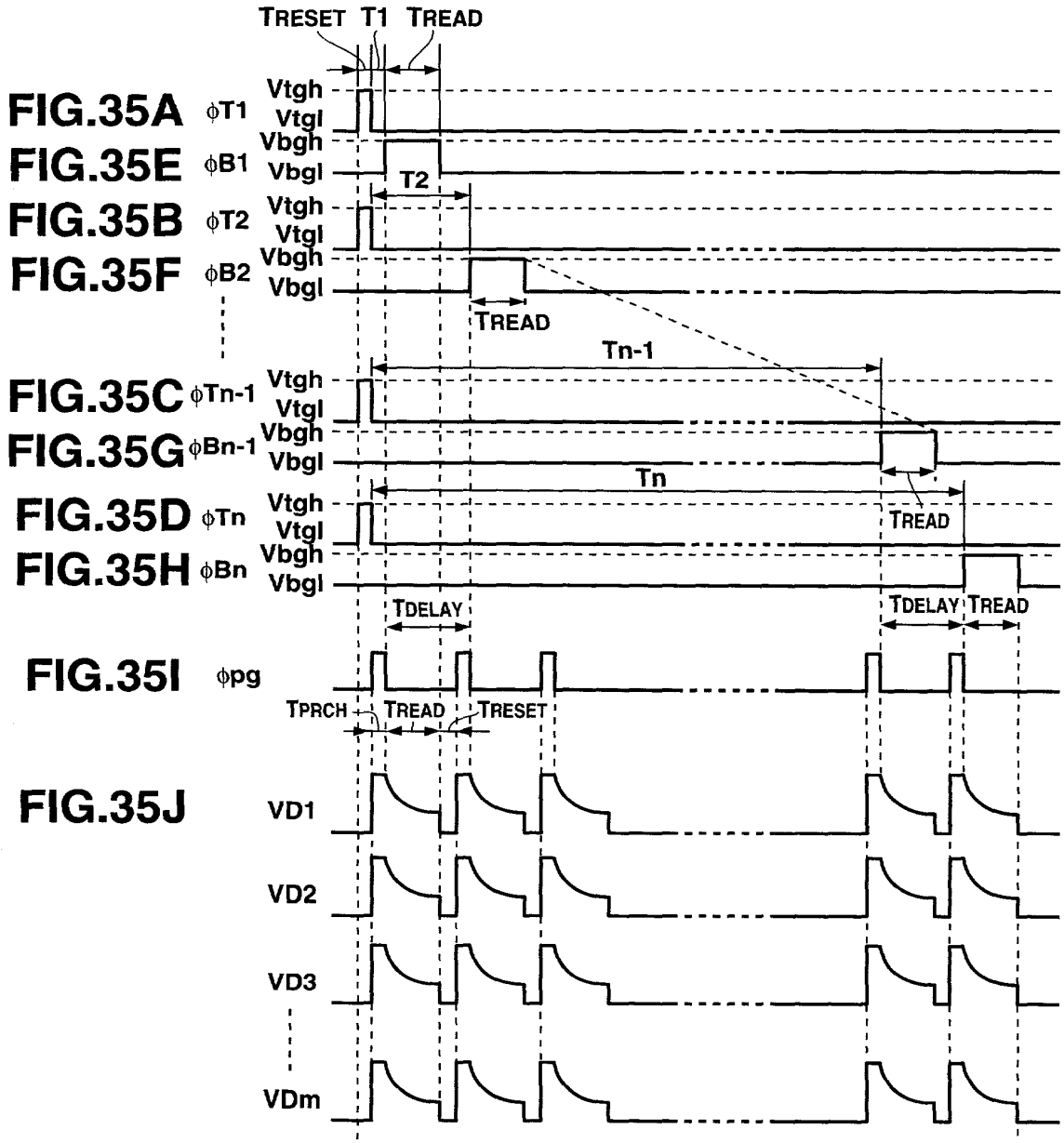
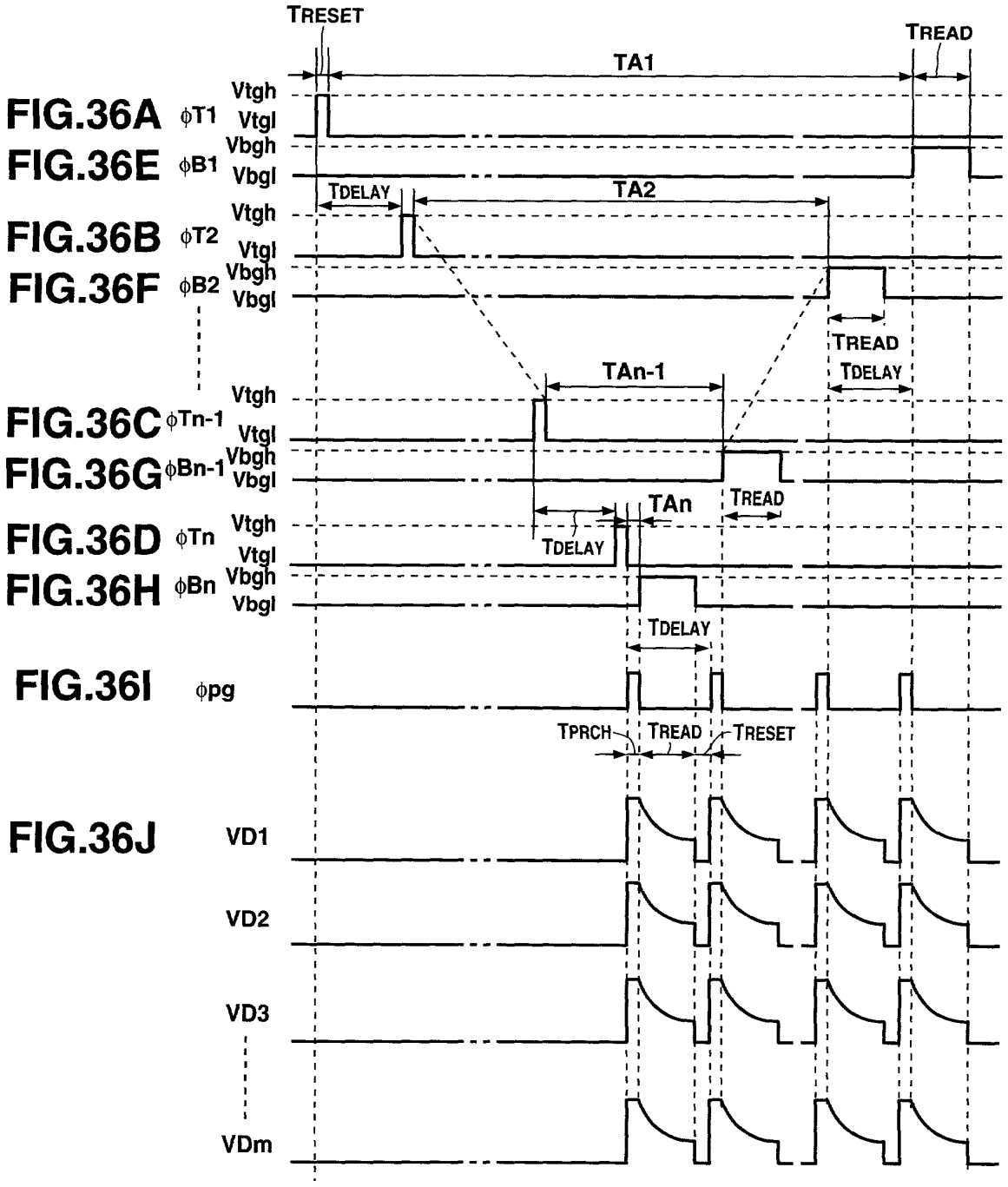
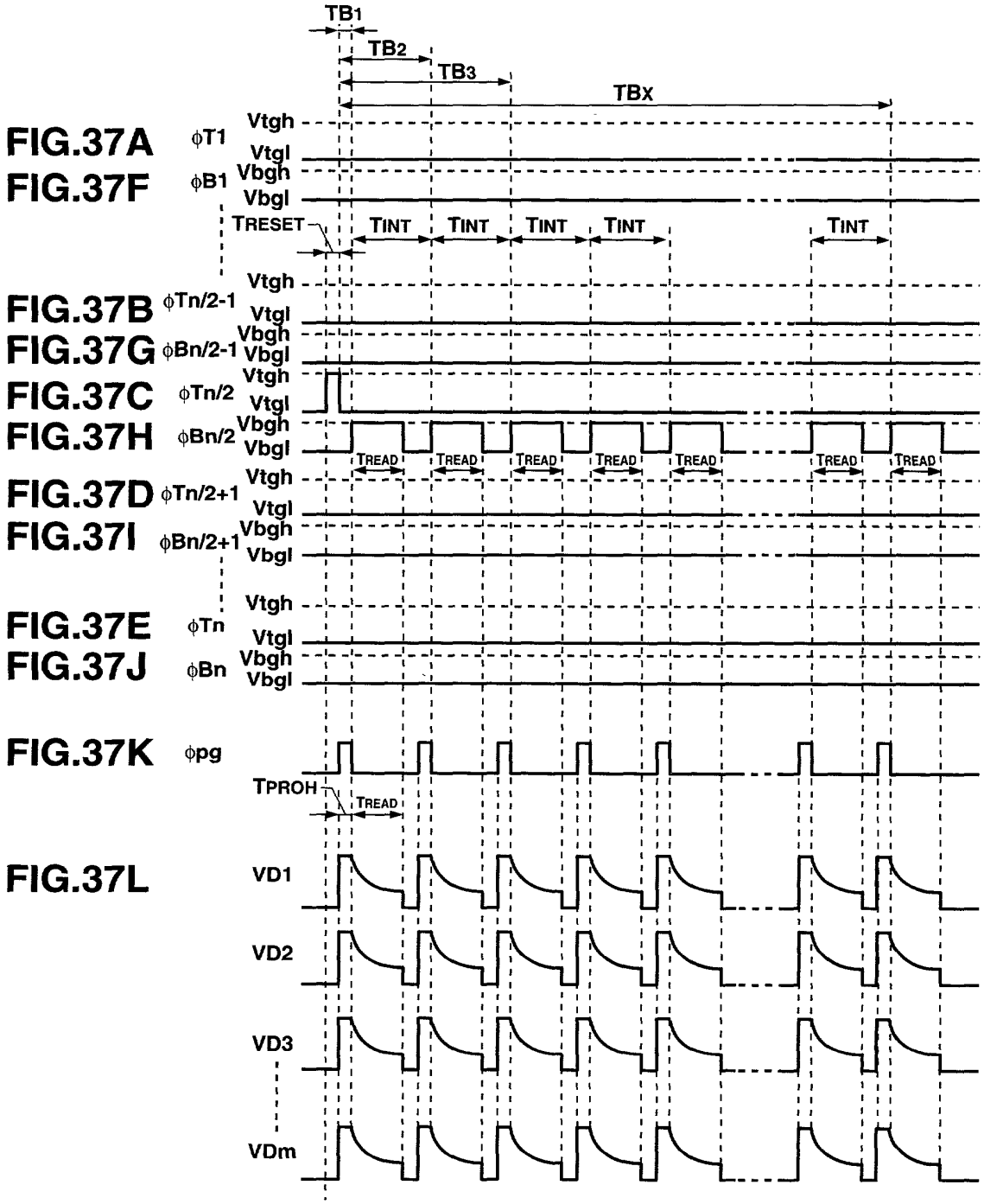
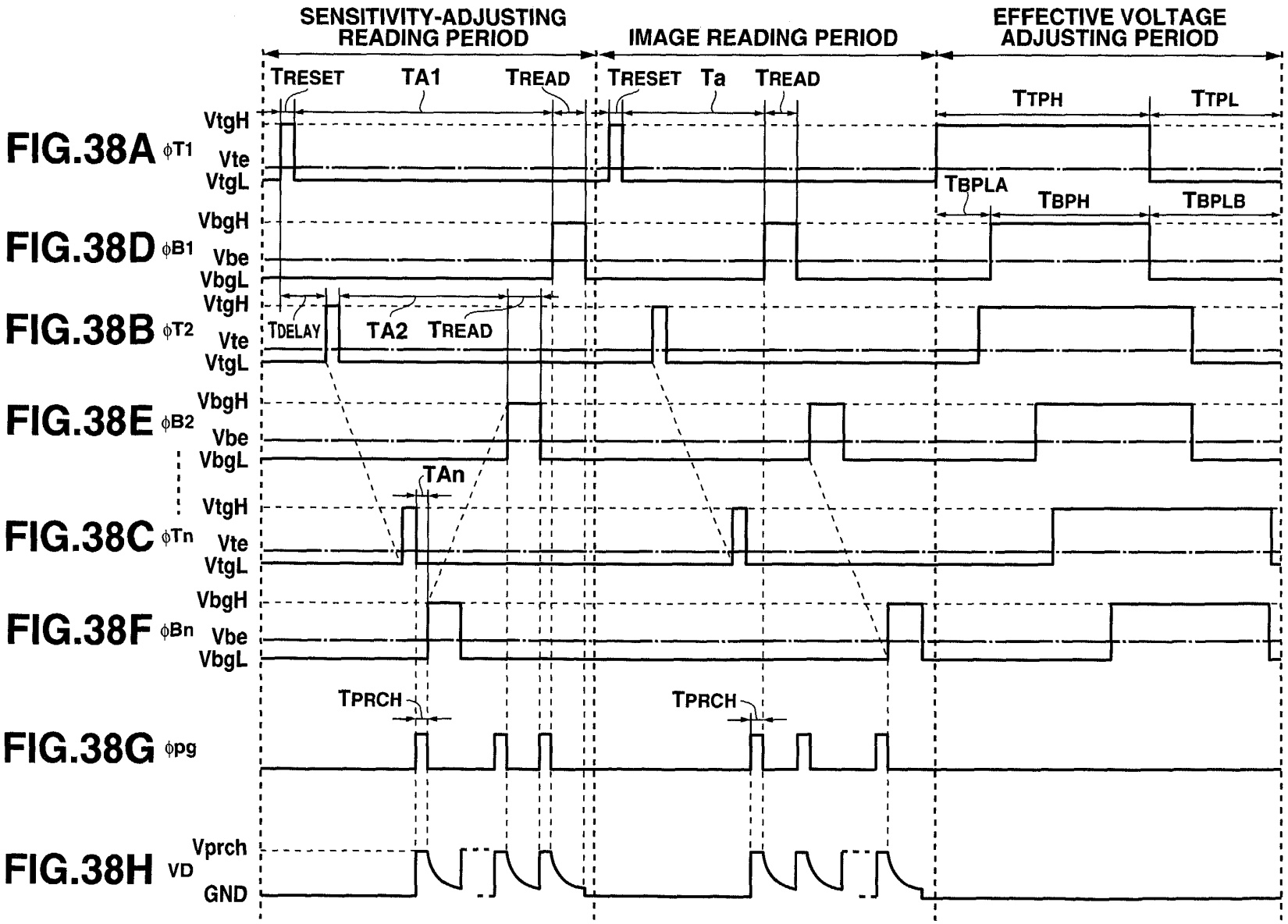


FIG.34E


TRESET
T1
TREAD
FIG.35A
φT1
Vtgh
Vtgl
FIG.35E
φB1
Vbgh
Vbgl
T2
FIG.35B
φT2
Vtgh
Vtgl
FIG.35F
φB2
Vbgh
Vbgl
TREAD
Tn-1
FIG.35C
φTn-1
Vtgh
Vtgl
FIG.35G
φBn-1
Vbgh
Vbgl
Tn
FIG.35D
φTn
Vtgh
Vtgl
TREAD
FIG.35H
φBn
Vbgh
Vbgl
TDELAY
TDELAY
TREAD
FIG.35I
φpg
TPRCH
TREAD
TRESET
FIG.35J
VD1
VD2
VD3
VDm


TRESET
TREAD
TA1
FIG.36A φT1
Vtgh
Vtgl
FIG.36E φB1
Vbgh
Vbgl
TDELAY
TA2
FIG.36B φT2
Vtgh
Vtgl
FIG.36F φB2
Vbgh
Vbgl
TREAD
TAn-1
TDELAY
FIG.36C φTn-1
Vtgh
Vtgl
FIG.36G φBn-1
Vbgh
Vbgl
TAn
TREAD
FIG.36D φTn
Vtgh
Vtgl
TDELAY
FIG.36H φBn
Vbgh
Vbgl
TDELAY
FIG.36I φpg
TPRCH
TREAD
TRESET
FIG.36J
VD1
VD2
VD3
VDm


TB1
TB2
TB3
TBX
FIG.37A
φT1
Vtgh
Vtgl
FIG.37F
φB1
Vbgh
Vbgl
TRESET
TINT
TINT
TINT
TINT
TINT
FIG.37B
φTn/2-1
Vtgh
Vtgl
FIG.37G
φBn/2-1
Vbgh
Vbgl
FIG.37C
φTn/2
Vtgh
Vtgl
FIG.37H
φBn/2
Vbgh
Vbgl
TREAD
TREAD
TREAD
TREAD
TREAD
TREAD
TREAD
FIG.37D
φTn/2+1
Vtgh
Vtgl
FIG.37I
φBn/2+1
Vbgh
Vbgl
FIG.37E
φTn
Vtgh
Vtgl
FIG.37J
φBn
Vbgh
Vbgl
FIG.37K
φpg
TPROH
TREAD
FIG.37L
VD1
VD2
VD3
VDm


SENSITIVITY-ADJUSTING READING PERIOD
IMAGE READING PERIOD
EFFECTIVE VOLTAGE ADJUSTING PERIOD
TRESET
TA1
TREAD
TRESET
Ta
TREAD
TTPH
TTPL
TBPLA
TBPH
TBPLB
FIG.38A φT1
VtgH
Vte
VtgL
FIG.38D φB1
VbgH
Vbe
VbgL
FIG.38B φT2
VtgH
Vte
VtgL
TDELAY
TA2
TREAD
FIG.38E φB2
VbgH
Vbe
VbgL
TAn
FIG.38C φTn
VtgH
Vte
VtgL
FIG.38F φBn
VbgH
Vbe
VbgL
TPRCH
TPRCH
FIG.38G φpg
FIG.38H VD
Vprch
GND

PRIOR ART

FIG.39A

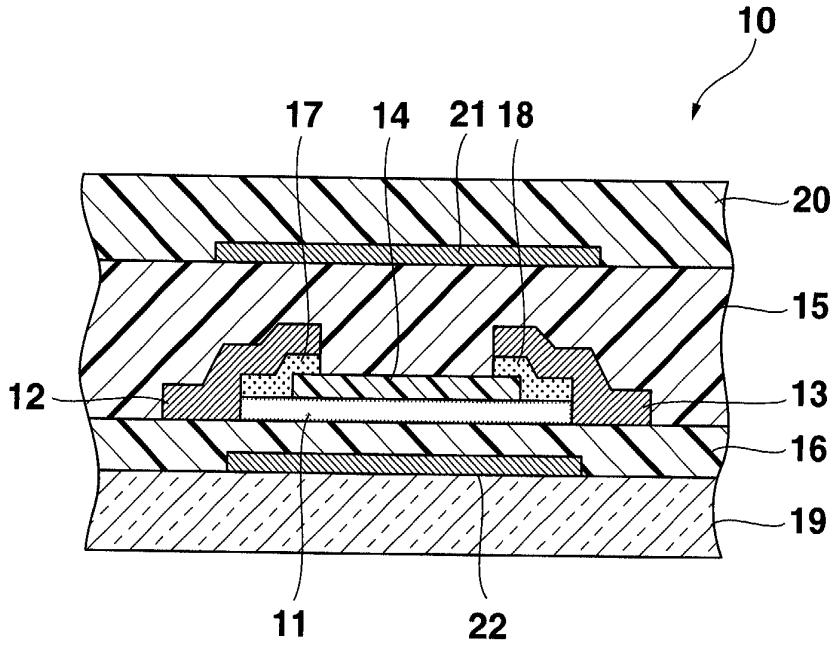
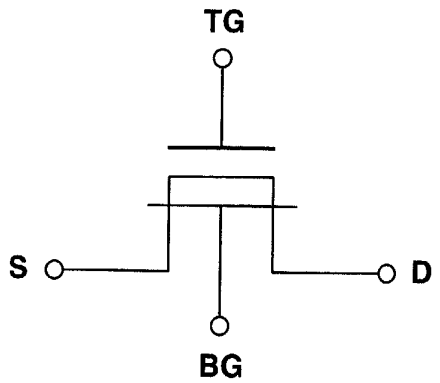


FIG.39B



PRIOR ART

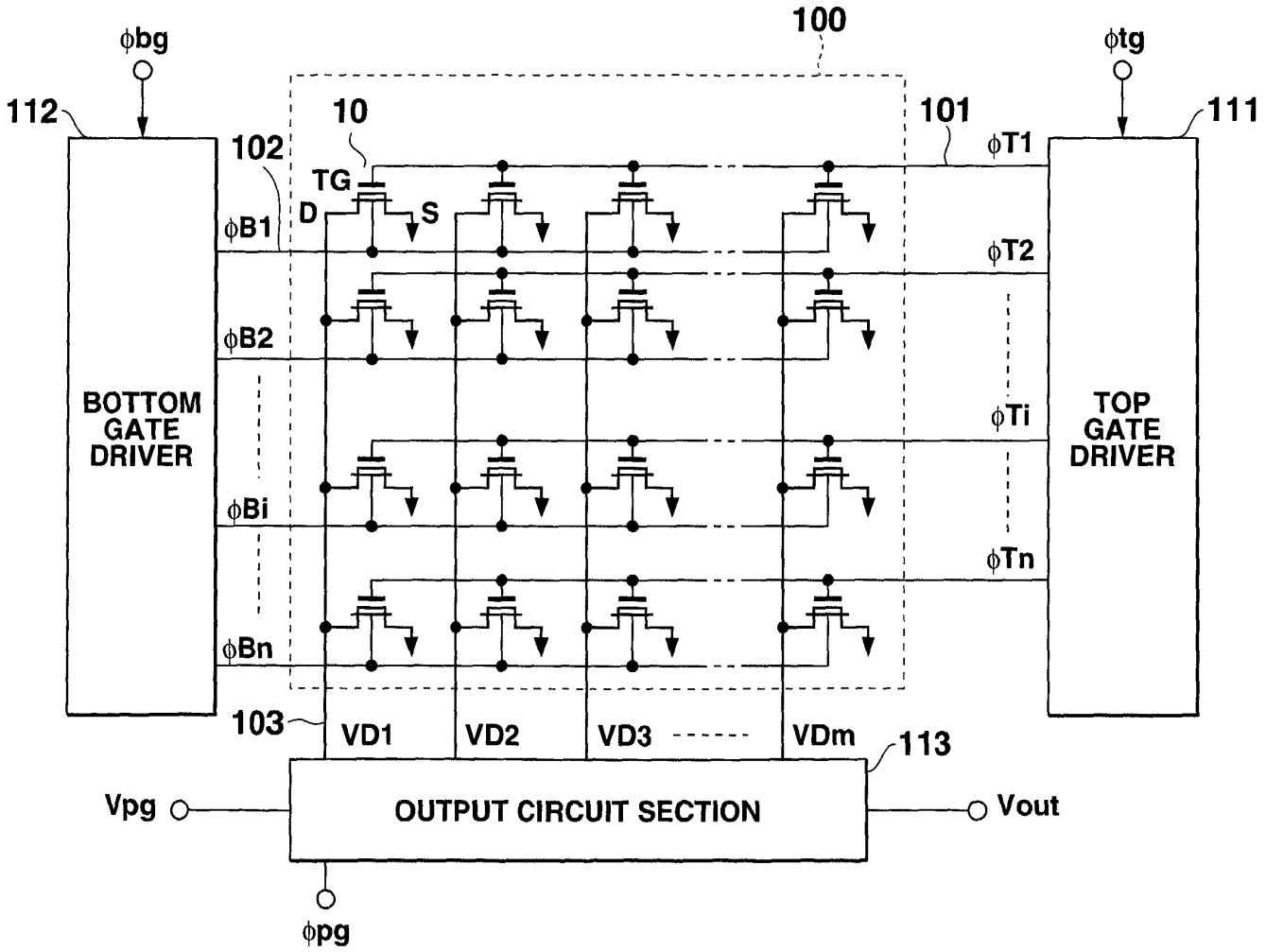


FIG.40

PRIOR ART

FIG.41A

FIG.41B

FIG.41C

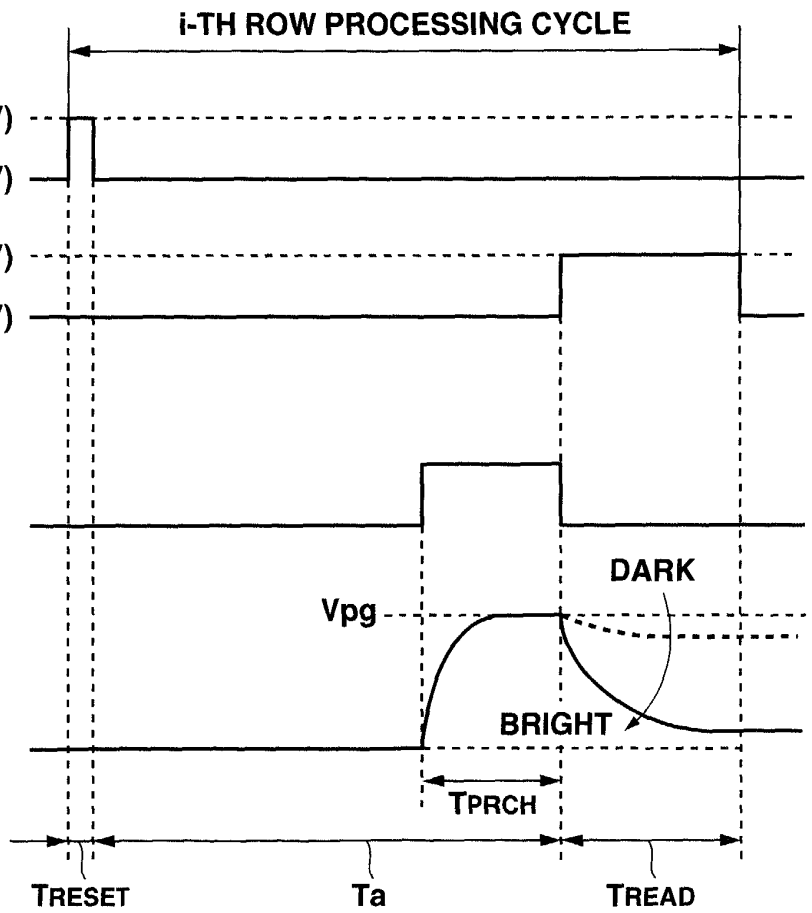



FIG.41D